MUSEUM MACAN

What a Cave Painting Has in Common with a Quantum Computer

Libby Heaney's research trip to South Sulawesi asks what humans lost and might regain when we learned to turn the world into images

In July 2025, British artist and quantum physicist Dr Libby Heaney travelled to some of the world's oldest known examples of representational art preserved on limestone cave walls. The research begins with a question: What does a 51,200 years old cave painting have in common with a quantum computer?

Dr Libby Heaney is used to working at peculiar intersections of science, technology, and art. Her art practice involves building installations inside quantum computers, using the same machines that tech companies and governments are racing to develop for cryptography and artificial intelligence. Working with Museum MACAN and the British Council's Digital Innovation programme, Heaney embarked on a journey that took her far from a scientist's laboratory and an artist's studio, but closer to humankind's innate intelligence. Prehistoric pictorial symbolism and quantum science do not, on the surface, have obvious business with each other; she was interested in what lay beneath the surface. Over several weeks, Heaney and a small team walked and climbed to four limestone caves in the karst hills of South Sulawesi, where some of the oldest known examples of representational art in the world are preserved on the rock walls: hand stencils, painted pigs, and abstract shapes made with red ochre pigment drawn from the stone.

The caves are cool, dark, and silent except for the occasional drip of water. To reach them, she was accompanied by a local group of archaeologists and stewards of the sites. Together they walked through villages and rice paddies, then hiked alongside steep paths overgrown with vines. Once inside, the temperature drops. The light from the entrance fades. Time does something strange. And it was here, sitting on the cave floor and looking up at images made by people whose lives and thoughts are entirely beyond our reach, that Heaney had the insight she'd come looking for

"Today, I've really been thinking about how caves are like quantum computers," she says in the research video produced during the visit. "Both are dark and cold and hold some sort of magical

alternative realities where meaning and matter are entangled and fuzzy. And there's almost like this threshold or like a portal or a gate where you step inside into this other space, this other time, where time becomes different, it becomes nonlinear, and multiple histories can exist at once."

Quantum computers must be kept at a temperature close to absolute zero, isolated from the everyday world in carefully controlled environments, because the delicate quantum states they rely on, particles existing in multiple places at once, entangle across space in ways that defy classical physics; they collapse the moment they encounter heat or interference. Caves, too, are thresholds: places set apart from ordinary time and space, where the usual rules don't quite apply. Both are the portals into states of reality we can't fully picture or control.

The intellectual heart of Heaney's project rests on two ideas that sound technical but aren't. The first *pre-reinterpretation*: the state humans existed in before we learned to make images of the world. "Before humans started to represent the world to create images of objects that they could see in their reality," she asks in the research video, "what was our consciousness like? Were we purely just working with sensation and in this pre-symbolic field?" The Sulawesi cave paintings, sitting at the threshold. They are some of the early evidence of humans turning what they saw and felt into pictures, marks on a wall that stand for something else.

The second idea is quantum aesthetics, a term Heaney uses to describe what happens when you try to make art with a technology that is, by very nature, unpicturable. Quantum physics operates at a scale so small and strange that it defies visualisation. Particles don't have fixed locations; they exist in clouds of probability. Cause and effect become blurry. Observation itself changes what's being observed. For Heaney, this isn't a limitation but an opportunity. Quantum physics, she argues, offers a way out of fixed dualism that has structured Western thought for centuries: subject versus object, observer versus observed, human versus nature.

What makes two ideas work together is that they are not opposites. Heaney is not saying that prehistoric people were primitive and quantum physics is advanced. She expressed that they might both be quotes toward the same thing: a way of being in the world that doesn't rely on pinning everything down, naming it, and putting it in a box. Pre-symbolic and post-representational. Before pictures, after pictures. Both states involve a kind of openness to not-knowing; a warm embrace to the mysteries that make up life as we know it.

The research video documents this embodied process in concrete detail. Heaney is shown in a protective helmet alongside Aisyah Arung Qalam, Pamong Budaya Ahli Pertama at Balai Pelestarian Kebudayaan Wilayah XIX, who points directly at the rock surface to identify motifs. She is also shown walking through a village with a local guide, and later working in a sketchbook in which the ancient cave imagery is being reworked through her own hand. Each represents a distinct mode of knowledge transmission—official heritage expertise, everyday local presence, and individual artistic notation—and their juxtaposition implies that the research process treats all three as legitimate inputs. Museum MACAN's role as Research Collaborator was essential here; as an institution whose practice lies in the production and distribution of knowledge, the Museum's direct involvement in this project expands the social role of museums today, creating opportunities for co-production and dialogues with various communities served by the institution. In the video, a museum representative frames the encounter as one that allows "two worlds that we think are opposing each other" to collide. The Ministry of Culture's role as Enabling Partner further situates the project within a formal framework of cultural exchange, distinguishing it from more extractive modes of international artistic engagement.

By rooting her inquiry in Sulawesi, Heaney argues that the future of post-representational technologies should be informed by knowledge systems from outside the Western scientific tradition. The prehistoric cave paintings don't offer answers, exactly. But they do offer a reminder that there was a time when humans didn't rely on pictures and categories to make sense of the world, and that humans didn't rely on pictures and categories to make sense of the world, and that time was just different. Quantum physics, in its uniqueness and refusal to be pinned down, might be pointing us back toward something similar.

This analogy is methodologically revealing. It is not the kind of insight that arrives through reading or remote analysis; it is grounded in the sensory experience of stepping across a threshold, of registering temperature and darkness, of feeling time behave strangely inside a contained underground space. Quantum computers, too, must be kept extremely cold and isolated from the everyday world to function. The pairing of these two spaces through their shared properties of coldness, threshold, and the suspension of ordinary temporality exemplifies the kind of knowledge the research process was designed to generate: empirical, conceptual, and embodied at the same time. Aisyah Arung Qalam frames the visit from another angle, observing

that the encounter represents "a very meaningful momentum" for those working on the heritage site. The research process is not only generating knowledge for the artist; it is also being read by Indonesian heritage workers as a meaningful event in the ongoing life of the site itself.

In late July, Museum MACAN presented a public program in Jakarta called "Sensing the Multiverses: Exploring the Magic of Quantum and Prehistoric Cave Paintings." The event included a workshop on quantum computing, a screening of Heaney's earlier speculative film *Q is for Climate (?)*, and an artist talk. The program was designed to bring quantum thinking — and the questions it raises about perception, representation, and knowledge — to a broader Indonesian audience. The research video, with its bilingual subtitles, does the same work: it keeps Indonesian voices speaking in Indonesian, rather than translating everything into English for an international art-world audience.

At the end of the video, Heaney offers a quiet hope. The works, she says, "open up cracks and holes like the caves as a space for magic and hope." The Sulawesi visit reminds us that the question of how new technologies will reshape our understanding of history, identity, and representation cannot be answered from within the technologies alone. It must also be answered from within the caves, communities, and cultural contexts that hold the longer memory of what representation has been—and what, beyond it, might still be possible.