Prehistoric cinema: A silver screen on the cave wall by Catherine Brahic

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With cartoon frescoes, shadow theatre and a rudimentary form of animation, our ancestors knew how to bring their stories to life.

THE small steel door in the mountainside is the same shade of green as the lush vegetation surrounding us. Before we enter, my guide, prehistorian Roberto Ontañón Peredo, asks if I would like him to switch on the main lights. I decide to discover this place the way my ancestors would have done, with just a small bubble of light. As the door closes behind us, we flick on our flashlights and their beams pick out the irregular walls of the El Castillo cave. What strikes me first is the size of the cavern: I've been in churches that could fit in here.

This cave, in northern Spain, was regularly visited by our prehistoric ancestors for tens of thousands of years, and as I follow Roberto inside, I see some of the extraordinary paintings they left behind. Red deer, bison and mammoths hide in the shadows, their outlines eerily materialising as the light catches the wall before vanishing just as quickly. But impressive as these images are, I am looking for something more dramatic - the world's oldest shadow theatre.

Over the past few years, a small number of prehistorians have claimed that cave dwellers pioneered a sort of show business. According to their analyses, our ancestors told intricate stories with their paintings, using visual trickery, 3D special effects and a form of shadow puppetry to bring their narratives to life. More impressive still, they may even have invented animation, using discs of bone to create the illusion of motion, much like a modern flip book.

Our story begins in the 1990s with Marc Azéma. A PhD student in palaeoanthropology at the Aix-Marseille University, France, he was surrounded by caves showing ancient illustrations of the animals that once roamed the landscape outside. Studying the many works on display, Azéma was intrigued by the fact that many of the images had lots of versions of the same animal layered one on top of the other. For instance, a horse painted at the La Marche cave in central France has five heads, two tails and at least six forelegs; a goat's body carved in a wall of the Abri du Colombier in south-west France, meanwhile, sits atop myriad legs that blur beneath it.

These layered images could be taken for preliminary sketches - the failed attempts before the real oeuvre took shape. But Azéma suspected they were more than the hesitations of an artist. For the next 15 years he pored over natural history publications and veterinary textbooks - anything he could find that described in detail the behaviour of the animals or their closest living relatives. What he found left little doubt in his mind. Far from being failed attempts to represent the animal correctly, each repeated limb and overlapping head was carefully executed to capture the animal's movements and give a sense of motion to the artwork.

To prove his point, Azéma unpicked the overlying images and then ran them in a loop. The resulting cartoons showed sophisticated illustrations of each animal's actions. The horse at La Marche, for example, pawed at the ground as it bowed and raised its head, and flicked its tail. Likewise, the goat's blurred legs translate to rapid movement.

Of course, the original audience would never have seen such sophisticated animations, but to a modern viewer they demonstrate the artists' skill in their attempts to capture motion. It shows, Azéma says, "a desire, a will to represent life", which he believes raises important questions about the purpose of the paintings. People used to think that they were purely symbolic, he says, without narratives. "That's wrong. From the moment it was invented, the image was there to tell stories."

To understand these artists' visions fully, however, you need to see their work in the conditions in which they were originally viewed. "All cave and rock art has been photographed and filmed wrongly," says Frederick Baker, a film-maker and archaeologist at the St Pölten University of Applied Sciences in Austria. Most prehistorians lit the cave paintings they were studying with

modern lighting, meaning that the murals are admired as a continuous frieze. But equipped with just stone lamps burning animal fat, prehistoric viewers would have seen the images unroll like sequential cartoon panels. First, they might have discovered a scene showing a lion, ears laid back on its head, watching its bison prey. As they moved further into the cave, they would have come to the next scene, in which the lion chases the bison. And so on. Telling stories like a slide show, this was interactive graphic art on a grand scale.

Crucially, the painters used subtle tricks of the light to bring these narratives to life. In the Cougnac cave in southern France, for instance, a 25,000-year-old painting of a giant deer known as megaloceros - now extinct - was aligned with the natural curves of the wall's surface. As a result, the outline of its chest and throat is created by a rounded volume, rendering the animal in 3D as light passes over and casts a shadow beneath the throat. Besides bringing depth to the painting, this might have created an opportunity to animate it. French prehistorian and author Michel Lorblanchet has argued that a flickering flame might have made the shadow contour of the megaloceros's chest vibrate as if it were breathing.

Similarly, the body of a goat is painted above thin vertical ridges of calcite that stick out of the wall. According to some researchers, they stand in lieu of legs, and a flickering flame would have created the illusion that they were moving.

Perhaps the most startling example of this artistry can be found in the El Castillo cave that I am visiting in northern Spain. In a chamber deep inside the mountain, we find a 3-metre-tall stalagmite, on the base of which is a painting showing a bison standing upright. A hazy charcoal outline forms a bowed head, two horns and a rounded back, while the two hind legs take the form of a human ankle and heel. The creature - thought to be a shaman dressed in a bison's hide - almost looks as though it was caught in the midst of a dance. It reminds me of Disney's unlikely hero in Beauty and the Beast.

My guide then moves the flashlight's beam up the stalagmite to its summit. Suddenly, I am shrunk by the looming presence of an upright, human-like beast whose dark shadow is cast on the cave's vast ceiling. A stubby horn leads into the mound of its powerful shoulders, then the outline drops vertically towards the floor. The head is bowed, the nose square, and as the lamp moves, so does the creature. It walks across the ceiling and, when Roberto casts the light from the opposite side of the stalagmite, it seems to turn to face the opposite direction.

Ancient animation

I had seen photos of the shadow beast before, but until this point I was cynical about whether it would really seem to move. But I am now convinced that whoever painted the bison-man was aware of its shadow, and might even have created it by shaping the stalagmite's peak. It would have been a terrifying sight 15,000 years ago, just as it is today.

From all these lines of evidence, it is clear that prehistoric artists were adept at evoking action and movement in the minds of their viewers. Until a few years ago, no one would have believed that our distant ancestors had gone beyond this to create an actual moving picture. But Azéma's latest work seems to show just that, offering evidence for a rudimentary form of animation.

In 2007, Florent Rivère, an artist who works in New York reproducing prehistoric artefacts, rang Azéma in excitement to declare: "I've found something". Rivère had reproduced a small disc of bone, carved out of a cow's shoulder blade. Discovered in the Pyrenees in the 1940s, the original disc is roughly 15,000 years old and the size of a large coin. On one side, a doe lies with limbs folded, while on the other it is standing.

Such discs were previously thought to be decorations or buttons - but Rivère had a different view. When he ran a piece of string made of tendon through the central hole, and spun the coin, the effect was exactly the same as a modern-day flip book: the doe fell and rose within a fraction of a second.

Azéma interprets a line on the doe's flank as an arrowhead and suggests it has just been shot and is slipping to the ground, but admits that this is open to interpretation. "What is clear," he says, "is that the animal changes position." To achieve the effect, the original artist must have aligned his drawings so that both images match perfectly, ensuring that only the legs move when the disc spins.

Azéma and Rivère have tested the theory on other coins. On one, a mammoth blinks as it opens and closes its mouth. Another shows a horse galloping. Working with limited materials, the artists were clearly highly skilled, says Azéma. "They pushed the limits of what they could produce."

There is much more work to do and more examples to find as we uncover this extraordinary preface to the history of the motion picture. According to the textbooks, the dawn of cinema broke on 28 December 1895 at the Grand Café in Paris, when Louis and Auguste Lumière dimmed the lights, closed the shutters and held the first ever movie screening. But standing in the enormous El Castillo cave, it certainly seems plausible that our fascination with the moving picture began much earlier - perhaps with the origin of art and culture itself.

3D pictures, caveman style

Not all prehistoric art appeared deep in caves. Although the images may be a bit weather-beaten, markings on open rock faces often show the artists' extraordinary techniques to best advantage.

"When you stand and watch the light fall across them, you know the experience would have been the same in the Copper Age, or the Iron Age. The play of light that we observe today would have happened each year back to 4000 BC," says Frederick Baker, an archaeologist at the St Pölten University of Applied Sciences in Austria, who is studying etchings in rocks at Valcamonica in the Italian Alps. Under the flat light of the midday sun, these pitoti all but vanish into the rock face. But catch them at dawn or dusk and you are in for a treat as the figures jump out at the viewer, rendered in 3D by the shadows of the etched grooves in the rock. The effect recalls the techniques used to create the illusion of depth in trompe l'oeil paintings.