Animation in Palaeolithic art: a pre-echo of cinema

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Marc Azéma a Palaeolithic researcher and film maker has been exploring the representation of animal movement in cave art for more than 20 years, and here shares with us his latest examples, culled from the parietal art in the Chauvet Cave (Ardèche) and La Baume Latrone (Gard). Here he has shown that Palaeolithic artists have invented systems of breaking down movement and graphic narrative. His co-author, Florent Rivère, discovered that animal movement was also represented in more dynamic ways—with the use of animals drawn on a spinning disc. In these flickering images created by Palaeolithic people, the authors suggest, lie the origins of cinema.

A short film accompanies this article: http://antiquity.ac.uk/projgall/azema332/.

Introduction

Palaeolithic art is thought to convey messages that may be naturalistic or allegorical in character, and both are the concern of the modern interpreter. The naturalist approach is "the consequence of the ever increasing meticulousness of archaeological research in all its aspects" (Clottes *et al.* 1994: 19). It is a compulsory methodological prerequisite in order to be able to discuss the likely use of allegory and symbolism.

Among the most important goals in this respect is the recognition that cave paintings were intended to represent both narrative and movement (Azéma 1992, 2003, 2005b, 2006, 2008, 2009, 2010, 2011; Clottes & Azéma 2005). A hypothesis which appears to

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Figure 1. The Grand Panneau of the Salle du Fond at Chauvet Cave, an example of Palaeolithic graphic narration with, on both sides, two successive hunting sequences displaying cave lions (photograph: J. Clottes, Chauvet Science Team).

be increasingly shared by colleagues (Tosello 2003; Aujoulat 2004; Fritz & Tosello 2005, 2007; Begouen *et al.* 2009; Lorblanchet 2009, 2010).

Even if it is obvious that we will never be able to prove with certainty that the Palaeolithic artist wanted to represent movement or a sequence of movements, the experience we have today allows us to assert that this hypothesis is more and more likely. In the present study, building on more than two decades of investigation and enriched by studies of ethology, we present new examples of the use of narrative and the representation of movement, on both cave walls and mobiliary art.

Representing narrative

The 'Grand Panneau' in the Salle de Fond at Chauvet (Ardèche) is a frieze over 10m long, that brings together most of the species known in the cave: cave lions, horses, bison, mammoths and woolly rhinoceros (Figure 1). It probably represents a hunting story, with two main events running from left to right along the decorated wall. At the end of the left-hand section, several lions, represented by the head and the start of the back, are shown stalking: ears back, head lowered, so as to pass unobserved. They look left, perhaps towards a lone small rhinoceros, painted a little further along the wall, or perhaps towards the viewer. The right-hand section of the Grand Panneau shows the second event and the star turn: the pride of lions lunge towards a troop of fleeing bison. The frieze here offers a perspective vision. Sixteen felines are placed in two parallel registers evoking two different

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'shots', the higher ones being smaller and thus farther away. Their ears are back in aggression. Some growl, others roar. According to C. Packer, a specialist in (African) lion behaviour (see Clottes 2001), the group is a mixture of females and males; in the very rare cases where they take part in the hunt, the males hold back and are not involved in the pursuit of the prey. The natural role of each protagonist, pursuer or prey, is respected. Prehistoric people must have felt close to the great herbivores, appreciating their social organisation (family group, hierarchical struggles) and their fight for survival (reproduction, migration), but they must also have been fascinated by the felines with whom they shared a fundamental preoccupation: the winning of meat. More than a naturalistic account, the Chauvet hunting scene can be read as an allegory, symbolising identification with 'the king of the beasts'.

The representation of narrative can also be observed at the small cave of La Baume Latrone (Gard), where several elements in the art also suggest a considerable age, even Aurignacian. The composition at the 'Grand Plafond' includes around 10 animals, finger-drawn with clay. At its centre, a large (3m-long) lion roars and on its own attacks a herd of mammoths, which lift their trunks and flee. Other mammoths depicted below are less agitated, suggesting a reading of events from bottom to top.

Magdalenian compositions show that the representation of narrative is also employed in the Upper Palaeolithic. The panel of the 'Petit sorcier à l'arc musical' engraved at the heart of the sanctuary of the Trois-Frères Cave (Ariège) depicts a majority of bison as well as several horses and ibex. At the centre of the composition, a 'sorcerer' (half-man, half-bison) is associated with an enigmatic image qualified as a 'musical bow'. Following ethological interpretation at Altamira (Freeman & Gonzalez Echegary 2001: 87–89), the bison images can be seen as expressing, in a sequential manner, different events occurring in a herd during the rutting season, which also constituted a propitious hunting opportunity for Palaeolithic people. Females on heat hold their tails with their genital orifice very evident; a male bison can be seen charging and, a little lower, clashing; others cross or chase each other with lolling tongues.

Representing movement

If these observations show that Palaeolithic artists were interested in representing a sequence of events, more detailed examination reveals that they had also developed techniques to show how animals moved. The artists arrived at two processes for breaking down movement, the first by the superimposition of successive images, the second by the juxtaposition of successive images (Azéma 2005a). By these two procedures, prehistoric man foreshadowed one of the fundamental characteristics of visual perception, retinal persistence.

In France, 53 figures in 12 caves represent movement using superimposition, shown by multiple images in the same place of the legs (31 cases), thus depicting rapid paces (trot or gallop), less often the tossing of the head (22 cases) and more rarely that of the tail (8 cases). Representation takes two forms: either by the addition of a second version, more or less complete, of the part of the body concerned, or by the multiplication of barely sketched contours (lines) around the head or legs, which generates a sort of dynamic flux. Lascaux is the cave with the greatest number of cases of split-action movement by superimposition of successive images. Some 20 animals, principally horses, have the head, legs or tail multiplied.
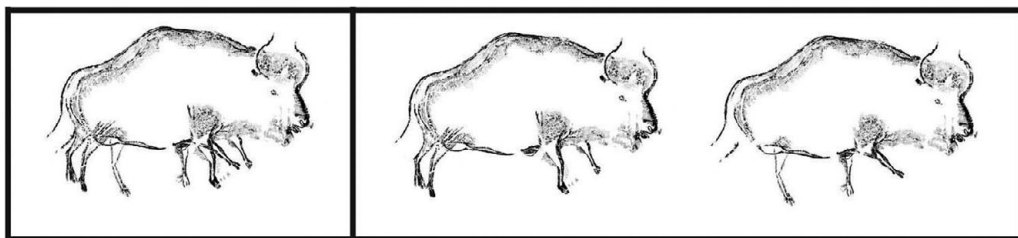
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Figure 2. An eight-legged bison drawn in Chauvet Cave proves that split-action movement was used from the Aurignacian. Drawing: C. Fritz & G. Tossello (Azéma 2005b).
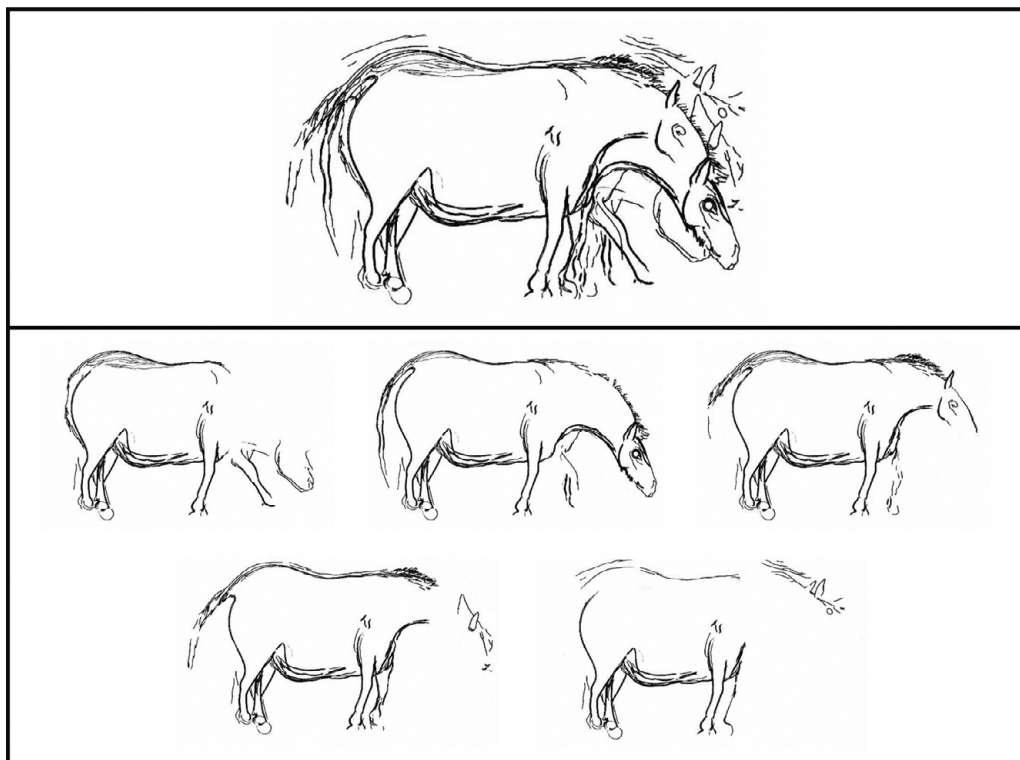

Figure 3. Split-action movement by superimposition of successive images in French Palaeolithic mobiliary art: horse at La Marche (Vienne). Drawing: L. Pales (Pales & M. Tassin de Saint-Péreuse 1981: pl. 71–73).

An eight-legged bison drawn in the Alcôve des Lions in Chauvet Cave proves that split-action movement by superimposition was already used from the Aurignacian (Figure 2). This graphic illusion achieves its full impact when the light from a grease lamp or a torch is moved along the length of the rock wall.

Examples are also fairly numerous in mobiliary art, the most obvious dating from the Middle Magdalenian (La Marche) and Upper Magdalenian (Limeuil, La Madeleine, Les Harpons). At La Marche (Vienne), an astonishing horse, engraved on a slab, has five or six heads, five or six forequarters and two tails (Figure 3).
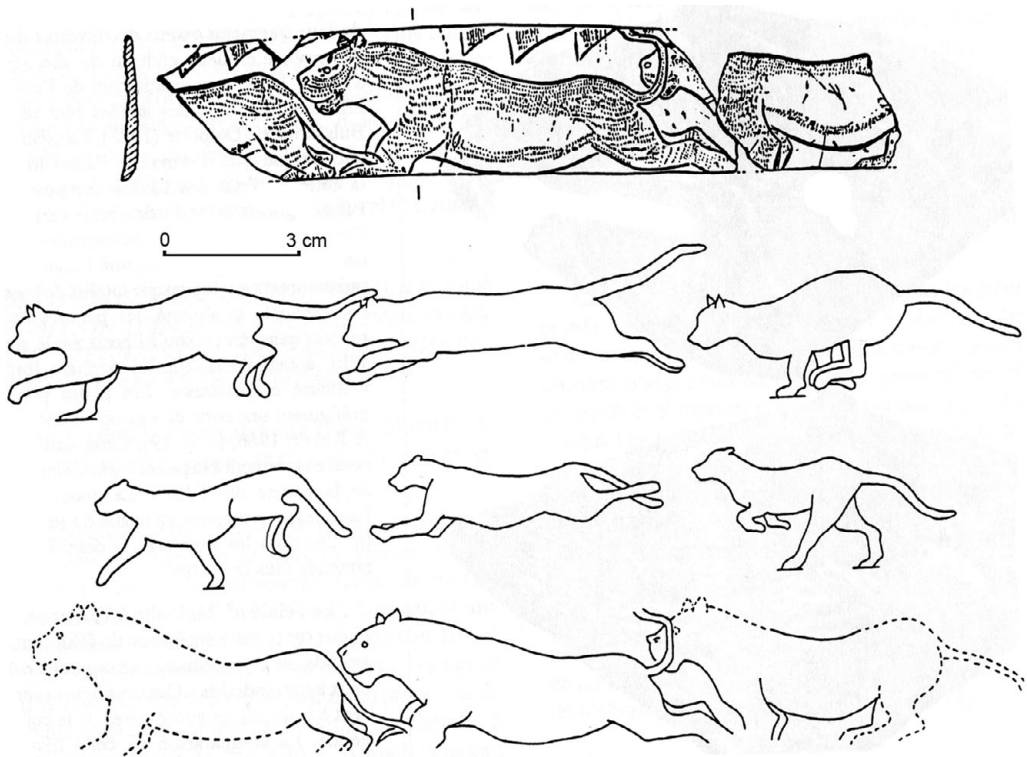
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Figure 4. Running in freeze-frame, from top to bottom: the lion frieze from La Vache (bovine rib). Drawing: D. Buisson (Buisson & Delporte 1988: fig. 3); the running action of a cat; the running action of a leopard; and a reconstruction of the running action of a lion depicted on the La Vache rib. Drawings: M. Azéma.

In other examples, movement is represented by juxtaposition. In this process positions taken up by the animal successively in a given time period are juxtaposed, one after another and turned in the same direction. Cases drawn from parietal art remain rare but at least one object, engraved at the end of the Magdalenian, is sufficient to certify its existence. A bovine rib, found in the Upper Magdalenian levels of the La Vache Cave (Ariège), shows, from left to right, three consecutive phases of a running lion (Figure 4). Although incomplete, the three images on the rib offer a good match to the freeze-frame images of a cat or leopard's run.

Palaeolithic thaumatropes

In 1991, we noted a possible case of movement by juxtaposition on two sides of a sandstone plaque discovered in the Isturitz Cave (Pyrénées-Atlantiques) by E. Passemard around 1940 (Passemard 1944; Azéma 1991: 121–22). The object measures 15.7 × 9.5cm and is attributed to the Magdalenian. On one side a reindeer is engraved, upright but probably wounded (with an arrow sign on its flank). Its rear members, stiffened, are sliding forwards, slipping away from the ground. A fall is imminent. On the other side a reindeer, seemingly the same individual, is found lying down, its four legs folded under the body, perhaps

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Figure 5. *Bone disc from Laugerie-Basse, face and reverse showing a chamois whose movement is in split-action: it's probably a 'Palaeolithic thaumatrope'. Diameter: 31mm. Drawing: A. Roussot (Roussot 1984: fig. 3).*

dying or dead. The artist has placed the two images making use of the plaque's contour, materialising notably the line of the back and influencing the two postures. "One has to pivot the object rapidly (at 180 degrees, making rapid back and forth movements with the hand holding the object at the base) in order to mentally superimpose the two spatially juxtaposed representations" (Azéma 1991: 286). This suggested that the disc might be used to create the illusion of movement by flicking rapidly from one image to the other, a principle later embodied in the thaumatrope, an early modern device involving rotating cards.

In 2007, this hypothesis was endorsed by studies made by Florent Rivère on Magdalenian bone discs. This type of object, found in the Pyrenees, the north of Spain and the Dordogne, measures around 4cm in diameter. Cut from bovine or cervid shoulder blades, the discs are generally pierced in their centre, or sometimes on the periphery, and have been generally interpreted as buttons or pendants. Given that some are decorated on both sides with animals shown in different positions, we realised that another type of use, relating to sequential animation, was possible.

One of the most convincing cases is that of a bone disc some 3.1cm in diameter found in 1868 by M. Hardy in the Laugerie-Basse rockshelter in the Dordogne and published in 1872 in *Magasin pittoresque* (Roussot 1984). One can see a herbivore, a doe or more likely a chamois from the shape of the ear and horn, the shape of the tail and small lines along the head (Figure 5). The animal is shown in two different positions, standing on one side of the disc, and lying on the other. The presence of angular signs on the body may indicate projectile impacts and explain the second position as that of the dead animal. The artist took care to frame the two images consistently in relation to the central perforation. The proportions are identical and the dorsal line works as an axis orientating both postures. We then had the idea that rapidly pivoting the object at 180 degrees (back and forth) would induce an optical effect in terms of retinal persistence, the capacity of the eye to retain an image already seen superimposed on the images being seen. Thus the movement would

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be reconstituted for the observer, as in an animated film. This effect, accentuated by the chevrons engraved on the edge of the two faces and focusing attention towards the animal in action, would be again accentuated in the presence of a fluctuating light from a lamp or hearth.

This hypothesis was verified by experiment using a reproduction made from the shoulder blade of a stag. Once the engraving had been done, manganese and grease were applied for colouring. A strand of natural tendon was passed through the perforation and connected to two twisted leather thongs (Figure 6). The rapid pivoting of the object was achieved by pulling at the ends of the twisted thongs as in the well-known children's toy. This rotates the disc about its lateral axis, and produces a superimposition of the two pictures on the retina: the animal goes down then gets back up in a fraction of a second and *vice versa*.

Thus, the Palaeolithic artists invented an optical toy, whose principle was to be found again with the invention of the thaumatrope in 1825, which is itself the direct ancestor of the cinematic camera. This device was invented by the astronomer John Hershel and later commercialised by the physicist John Ayrton Paris (1785–1856). The thaumatrope, literally 'miracle wheel' (from the Greek *thauma*, 'prodigy' and *tropion*, 'turn') is made up of a disc with a design on the two sides, and held above and below by a cord. There is, however, a small difference between the later optical toy and the discs presented here: the position of the perforation. On the recent thaumatrope there are generally two perforations near the edge of the disc. On the archaeological pieces, there is most often only a central perforation. The string has to be attached differently, but above all, the axis of rotation must be adjusted for a successful visual effect, contrary to the

Figure 6. The Laugerie-Basse reconstructed disc in movement: experiment of a 'Palaeolithic thaumatrope' by Florent Rivère. Extracted images from a film documentary directed by Marc Azéma in 2009 (©Passé Simple).

historical thaumatrope where the axis of rotation is defined by the two holes situated at the extremities of the diameter of the disc. However, certain discs have perforations on

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the periphery of the disc, as at Mas d'Azil (Péquart & Péquart 1961: figs 150–152). In positioning the strings in these small holes, once again, the system functions perfectly.

Other Magdalenian bone discs, whole or fragmented, seem to offer similar examples of animation. A mammoth from Raymonden (Dordogne) (Sieveking 1971) has an eye that opens (circular profile) and closes (almond-shaped profile) while the mouth half opens. The artist seems to have wanted to represent the moment where the animal passes from life to death, the climax of a hunt: a set of chevrons marks the mammoth's brow, signifying the casting of a deadly projectile. A disc found at the site of La Tuilière at Saint-Léon-sur-Vézère (Dordogne) shows the movement of an equid, from right to left, in three successive images. At Mas d'Azil (Ariège), a bone disc shows a sort of 'morphing', recording the passage of a young calf to adulthood in two images (Péquart & Péquart 1961: figs 150–153). Other discs show graphic animations based on purely geometric motifs: for example, a disc with multiple perforations generating an animation based on a succession of motifs in the form of chevrons and oblique lines which could be expressing the trajectory of a projectile, a simple dynamic effect or a visual hallucination.

Conclusion

It can be seen that Palaeolithic artists designed a system of graphic narrative that depicted a number of events befalling the same animal, or groups of animals, so transmitting an educational or allegorical message. They also invented the principle of sequential animation, based on the properties of retinal persistence. This was achieved by showing a series of juxtaposed or superimposed images of the same animal. That such animation was intentional is endorsed by the likely use of incised disks as thaumatropes. Well in advance of their nineteenth-century descendants, Palaeolithic thaumatropes can be claimed as the earliest of the attempts to represent movement that culminated in the invention of the cinematic camera.

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