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PLEISTOCENE ART OF THE WORLD

Short articles



## THE ACOUSTIC DIMENSION OF PALEOLITHIC PAINTED CAVES AND STONES

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Numerous studies of the acoustics in Paleolithic caves decorated with paintings, engravings and diverse signs have revealed a remarkable correlation between the images and the quality of the resonance where they are located: most of the images are situated in the most sonorous parts of caves.

### Density of images and resonance

In general, the density of the images is proportional to the intensity or richness of the resonance. A simple method for measuring the richness of resonance is to count the number of echoes obtained from the resonance of a human voice. At the Grande Grotte of Arcy-sur-Cure, for example, as we advance inside the cave from an area with 2 echoes, to another with 4, to 5 and then 6 or 7, the density of images increases as well, until they finally cover nearly the entire ceiling of the terminal apse, as well as the lateral walls and niches. In Kapova cave, as we pass from 4-5 echoes (Hall of Signs) to 5-6 echoes (Cupola Hall), and then into the upper level, with as many as 7-8 echoes, the paintings become increasingly dense in terms of both painted surfaces and remarkable panels. At Niaux, this increase in image density is clearly related to the intensity of resonance; this is especially evident in the density of images in the Salon Noir, which is a very sonorous space (7-8 echoes, duration 7 seconds).

### Remarkable places

The Niaux Salon Noir is exemplary in its abundance of paintings all around the Salon and in their quality, as well as in the sonority of this rotunda, which resonates like a Roman chapel. The sound/image concordance is exceptional here: imitating animal sounds (figure) gives a real impression that they are there in the cave. In terms of sonority, we can to a certain degree compare the Salon Noir with the Great Hall of Isturitz, a true concert hall in which we find the famous pillar decorated with reindeer; it is also here that flutes made from bird bones were discovered. The Hall of Paintings at Kapova is also a special place, being both sonorous and containing two magnificent panels with bison, horses and especially mammoths.

### Decorated sonorous niches

These are niches into which we can partly enter, sometimes only with the head. They are often very sonorous and decorated, either inside (Camarin of Le Portel, completely decorated), or outside, where there are often red dots, or in their immediate proximity. In these niches, a human voice with *mm*'s or *hm*'s of medium intensity can create spectacular imitations of animal cries and bison moos or roars, what we call the "bison effect".



Niaux, Salon Noir, Pannel 6,  
a place rich in resonance (photo: J. Clottes).

## Red dots

The red dots that are numerous in some caves appear to be signs that indicated very sonorous areas, or that served as guides in the cave by use of its resonance. This function appears quite clear in narrow tunnels where red dots are found in the very spots where the resonance is greatest. This is the case at Le Portel, where in a long, narrow passageway the only sign present is one red dot that is easy to locate by searching for the acoustic center of the tunnel with a voice. In Oxocelhaya cave, there are two such tunnels, one in the Laplace Gallery, opposite a falling bison, and the other in association with a whole network of red dots and lithophonic stalactites; the red dots are always found at the point of maximum resonance. This coincidence is so remarkable that its conclusion seems certain: these are signs with a purely sonorous significance, serving as guides in these narrow tunnels.

## Statistical considerations

When considering the sound / image relationship, we can of course wonder if the seemingly clear concordance in a given cave is simply accidental. However, in many caves, since more than 80%, or even 90%, of the images correspond with sonorous locations, it would be difficult, or even non-scientific, to speak of accidental coincidences. This coincidence can be calculated very precisely in the case of red dots located at the point of maximum resonance in some tunnels. When we consider the type of red dots found at Le Portel and Oxocelhaya, we obtain probabilities of approximately one millionth that the four red dots concerned would all be located at the point of maximum resonance (which is the case). These probabilities are almost null and the sonorous significance of these red dots in tunnels appears even more certain given that there is no more reason for a red dot to be placed there than elsewhere.

## Paintings on stones in the open-air

We have also studied the resonance in areas surrounding stones decorated with paintings on lakeshores in Finland, in the Massif de la Sainte-Baume in Provence, and in the Vallée des Merveilles. At this latter site especially, the results of our first study were remarkable. In the middle of a natural setting, we heard mostly echo effects, and sometimes surprising ones.





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