

Animals as Earthquake Predictors: Superstition or Salvation?

A reunion in Friuli

For me the challenge and adventure of earthquakes began in a small town on the eastern flank of the Peruvian Andes. The front page of a newspaper I bought from a street vendor showed a village in the mountains that had been turned into a field of rubble by a quake. Search parties were digging for survivors. It was one of those great tragedies we tend to think happen only to strangers, but I quickly realized that I knew the site of the disaster very well. The village in which I had grown up and in which my parents still lived was only about 20 kilometers (12¹/₂ miles) from the epicenter.

By the time I was driving homeward through the destroyed Friuli countryside, I knew that my parents had escaped with only a scare but that their old house was a broken-down ruin. As prepared as I was to see some depressing sights, I was still shaken when I finally got to look at the peasant village in which every stone had once been familiar. A dozen of the sixty-odd houses in the village had already been bulldozed flat, and the rest, gaping with cracks, had been braced temporarily and were in danger of collapse. The people who had lived in them were now living in army tents and in roughly built huts in the fields, and salvos of aftershocks were still shaking the countryside. The world these people had known had collapsed.

I had known many of the villagers since my early youth. Even though I had to look after the affairs of my family in the ensuing two weeks, I did get a chance to talk to most of them. As they told me of their experiences, life and color began coming into what at first had been an abstract calamity whose specific attributes were a 6.5 on the Richter scale and a time of 9 P.M. on May 6, 1976.

Eyewitness reports unmistakably drew the outlines of a phenomenon that is as old as the history of earthquakes and has just as long been enigmatic and controversial: the premonition of earthquakes by animals. Some peasants had been calming their cattle in the barn or checking to see why the dog was barking when the earthquake struck. Others remembered that cats had not appeared for their feeding on the evening of the quake. There had been no living tradition about earthquakes, because destructive earthquakes happen too far apart in time. Thus, the peasants had no preconceived notions about earthquakes. The animals had shown such vivid fright that the peasants later asked me, as a scientist, to explain why animals could recognize a coming earthquake.

Once I had gotten over my initial confusion and surprise over these reports of animal earthquake premonition (which I had never taken seriously) and looked at the tragedy around me, I decided to make a careful collection of these observations. I wanted to see whether they were consistent with one another and with analogous older reports. Most of the information about the behavior of animals before the earthquake was collected in my home village of San Leopoldo, formerly known as Leopoldskirchen. Other reports came from surrounding communities (Pontebba, Apua, Malbourgetto) and from the area of the epicenter.

For two days before the quake and two days afterward the weather had been sparkingly clear. Daytime temperatures had climbed to nearly 30°C (86°F). There had been no atmospheric disturbances. Other than the fact that it had been uncommonly warm and dry and oppressively close on the day of the great quake, people had noticed nothing out of the ordinary. The only thing worth mentioning had been the singular behavior of animals. Many peasants who had been working in the fields had noticed that the woods that cover the mountains down to the village of San Leopoldo had been surprisingly noisy. Again and again the rough-sounding call of the roe deer could be heard, a rarity at that time of the year. Late in the afternoon of the day of the earthquake, some witnesses were startled to see something they had never seen in this game-poor region: On the steep grassy slopes a few hundred meters above the village about fifteen roe deer were crowding together as tightly as they were able. A short distance away stood four red deer. One man who had watched the animals through binoculars had noticed that they had kept their heads down but had not been grazing. Usually, wild game would come down into the valley in herds only in the harshest winter or during the most severe thunderstorms.

Domestic animals, too, had changed their behavior that day without apparent reason. Chickens, who proverbially roost early, could not be persuaded to go into their coops. In some farmyards it took until 8 P.M., two hours past the usual time, to get them into the coops. One peasant, when asked what he had been doing shortly before the quake, said he had been chasing a recalcitrant rooster around the barnyard. On another farm, when the people rushed outside just as the great quake's minute of trembling started, they found the chickens already fluttering around all over the garden. They had evidently gotten out of the coop somehow before the quake had started.

At the time of the quake not a single cat was to be seen in the entire village, according to several people. These animals, otherwise numerous, had disappeared without a trace. Two to three days after the quake they returned, just as mysteriously. Several cats that could be depended on to show up at 7 P.M. for their evening meal had not shown up on the day of the quake. Two mostly wild cats that had been coming to an old woman's house at the same time every day to be fed before slipping back into the woods did show up, but seemed very nervous. They accepted no food, and they ran away from their benefactress.

A cat living at another farm had recently had kittens. On the day of the quake she had carried them from the attic and quartered them in the vegetable garden. A somewhat similar case was reported to me by a family in Ospedaletto, very near the epicenter. This family's two cats, which had been raising kittens, both carried their litters from the house into the garden just before the earthquake. When the man carried some of the kittens back inside to their nests, the anxious mother cat carried them back out again. One woman remembered that her cat had been trying to leave the house immediately before the earthquake hit. The cat kept jerking its ears, and ran nervously around the house.

Also noteworthy is the report that in a different community people living on a farm became quite irritated to see mice and rats running around freely while their five cats were nowhere to be found. The rodents had evidently left their hiding places after the cats had sought the great outdoors.

Two people living in a remote Alpine cottage noticed not only the repeated calling of roe deer but also the wailing of a wild cat.

Many peasants remembered their cattle kicking up a commotion. After they had been fed and watered, the animals began lowing and tearing at their chains for no apparent reason. This kind of behavior was reported to have started about 15–20 minutes before the quake.

The various witnesses agreed rather closely as to time. Some observers later thought they had noticed unusual behavior as much as an hour before the quake. One peasant, who rushed into the barn on hearing the commotion, found his six cows vigorously bellowing in concert and furiously flapping their ears and whipping their tails.

The unusual behavior of dogs, which was noticed about 20 minutes before the earthquake, astounded many observers. An innkeeper told me that his two dogs had suddenly started to bark furiously in the yard and had pawed at doors and windows. When he tried to let them in, they refused to come, slunk back, and ran in circles howling. As soon as the door was closed again, they started pawing it desperately and jumped against it. The innkeeper tried again, but could not lure them into the house. While he was trying to calm his four-footed friends—it was a few minutes before the earthquake—he noticed that the fields and the woods were resounding with bird calls even though it was already dark. He was able to make out the call of the cuckoo clearly. When the earthquake struck, his dogs ran away in panic. One returned three days later and the other after five days.

Other dogs had behaved just as strangely, except that they had not run away. One bitch dragged her puppies out of the house into the open before the earthquake. One woman, whose dog had always slept in the house, could not lure the animal back in on the evening of the earthquake. A peasant woman who lived alone did manage to get her little dog to go into the house about 10 minutes before the quake, but he snarled and barked so much that she decided to take him for a walk despite the late hour. When the quake came, the dog was under the sofa, trembling and curled up into a ball. In another case, a dog that had been especially good-natured until then bit the boy he usually played with. This happened late in the afternoon of the earthquake.

Among other precursors of the approaching earthquake were the strange sounds made by yard fowl and wild birds and the timing of these sounds. On one farm the chickens set up such a shrieking just before the quake that the people thought a fox had gotten into the coop. They rushed out to the coop with sticks in their hands. Around midnight on May 8, about 2 hours before a particularly heavy aftershock, a man lying in his tent heard cocks crowing and another man was surprised to hear blackbirds calling at that time of night.

At least two people had noticed, independently of each other, that during the seemingly endless series of aftershocks their roosters would signal a shock regularly by making a sound which they rendered as “Krrr . . . Krrr . . .” These are the same sounds a rooster makes to

warn the flock of hens of an approaching hawk. One man seriously considered killing his rooster because he couldn't take much more—each time the bird gave forth its “Krrr” sound, the man without thinking would dash headlong out of the now rickety house.

Caged birds behaved in remarkable ways just before the earthquake. Owners of canaries in six houses in three different villages reported the same observation: About 10–15 minutes before the quake, the birds began jumping around and calling out. Then they would flap their wings energetically and fly around inside their cages. One observer reported that his birds kept flying up against the ceiling of the cage. One woman threw a blanket over the cage but was unable to quiet her birds. Of four birds in one cage only two survived the earthquake, and one bird died in another cage. The causes of their deaths remain a mystery. The birds may have succumbed to overexertion when they tried to fly.

One woman told me about a water container in the cage of her parakeet that she had usually filled daily. The bird drank from it and bathed in it, using up about half a container per day. On the afternoon of the earthquake, she noticed that the container was empty. It could not have been the heat, because her stone house stayed fairly cool. She refilled the tub only to find it empty again a little while later. Since the bird could not have drunk all that, it must have been bathing all the time. After the earthquake, the observant woman thought she could detect heavy water consumption on the part of her bird before each of the many aftershocks, and she used the water level as her private earthquake forecast.

The many aftershocks allowed the people in the earthquake zone to repeat certain observations, and they accumulated an astonishingly rich store of details in this manner. For example, a man who moved into his bee shed after his farm was destroyed noticed that the beehives were a lot noisier than usual just before a quake. Animals seemed to sense danger in the air as the many aftershocks continued weeks after the great earthquake. Chickens, for example, roosted later than normal, and cats came home only long enough to eat.

More than four months after the main earthquake in Friuli, a second destructive earthquake struck the area on September 15 at 11 A.M. With a force of 6.1 on the Richter scale, it was noticeably weaker than the first quake had been. When I checked around, I found markedly fewer recollections of excited animals than there had been before the big quake. This may, in part, have been due to the fact that at the time of the tremor many peasants were working in their fields,

far from the domestic animals. Besides, the animals must have been used to the phenomena after the hundreds of aftershocks.

Apart from isolated reports of barking dogs and fleeing cats, two additional observations are worth mentioning. Two peasant women were talking between their houses when they noticed the noise made by a swarm of sparrows that were fluttering around one of the gables. One of the women remarked that she hoped this was not a sign of another impending earthquake. They had just changed the subject when the earth shook again. The other observation concerns the unusual behavior of swallows. Having left on their fall migration several days before, they returned to the village and their nests on the morning of September 15. About half an hour before the quake, they all flew away again—this time for good.

In view of this plethora of unusual observations of animals made by the peasants shortly before the catastrophic Friuli earthquake of May 6, 1976, the question naturally arises of why the peasants did not become wary and suspicious. The explanation is simple: Their own animals represented only a small segment of the total phenomenon, and the great herd of roe deer approaching the village was such a peaceful sight that the observers—even after the earthquake—did not make the connection with the earthquake (only I suspected that).

When a scientist comes up against a totally inexplicable, mysterious phenomenon, he is inclined to be cautious. If he is smart and concerned about his reputation, he will take no public position on it. But when the phenomenon is one on which life and death may depend, and when those enigmatic observations made under tragic circumstances are passed on to him by people whom he knows and trusts, then he cannot escape serious conflicts of conscience.

The prejudices of science

The sociologist of science Stephen Toulmin was of the opinion that in the development of scientific advances, much as in the development of species in the course of biological evolution, changes result from the selective propagation of variants. His colleague Thomas B. Kuhn also inclines to the view that the laws governing scientific progress are similar to those that govern natural selection. In any given historical situation, and within the available options, the fittest are selected. The question of whether that choice is the best that could have been made is not even asked.

Comparing scientific development with natural evolution is an attractive exercise. Science sometimes shows leaps of development that

may be compared to mutations in biology; sometimes there is faulty evolution that leads into a blind alley, which compares to the extinction of overly specialized animal species; and sometimes there are independent rediscoveries of similar principles, a phenomenon that can be found in nature time and again. Just as animal species evolve almost explosively in a new and for them favorable direction when they suddenly discover a new range or niche, so science skillfully exploits every opportunity that a generous society or even such emergencies as wars or supply crises may offer.

These governing criteria should be kept in mind when the following questions are asked: Why did modern earthquake research, throughout its stormy development in the twentieth century, close itself to the rich oral tradition of earthquake predictions? Why did earthquake research stubbornly insist that the detailed reports of unusual animal behavior before earthquakes, of springs that turned muddy, of odd displays of light, and of other such phenomena were nothing but figments of the popular imagination, when they reappeared after every great disaster through hundreds and thousands of years? Why have many recognized earthquake researchers denied time and again and in a very unscientific manner that there is even the possibility of a measure of truth in these reports, without ever having seriously collected the relevant documents or scientifically analyzed the phenomena?

Many explanations could be advanced for why scientists tend to be reserved and reticent when faced with old folk wisdom. Since scientists are bound to know that earthquake survivors' recollections will be colored by the shock and suffering they went through, could it be that this condemns these recollections to be met by disbelief? However, it would seem that the many existing reports and assertions about mysterious earthquake signs that agree with one another deserve at least an earnest attempt at contradicting and weakening them. The suspicion that such prejudices of science cannot be blamed entirely on the difficulty involved in observing and studying these phenomena, but that these prejudices should rather be ascribed to complex criteria governing scientific circles and to "environmental influences" in the evolution of science, is confirmed by the remarkable example set by the collective earthquake watch in the People's Republic of China.¹⁻⁴

China breaks the spell

In June 1974, China's National Earthquake Bureau issued a warning that a serious earthquake should be expected in Liaoning province in

the next year or two. This prediction had been preceded by an investigation of four years. The investigators had carefully studied the 2,200-year earthquake history of the region, and their conclusion that geological changes were imminent was buttressed with precise seismological, geodetic, and geomagnetic measurements.

This warning had two immediate consequences: The scientific observation network was expanded (partly through the use of portable measuring stations), and the people were mobilized. The latter move had been the backbone of the national earthquake prediction program since 1966. With the guidance of experts, amateur groups were organized and trained in thousands of industrial plants, schools, animal breeding institutions, and agricultural communes. Their task was to recognize signs of imminent earthquakes and to pass them on to a central clearing house.

Comparatively few of these groups were charged with measuring physical data, such as periodic changes in electric ground currents, and these measurements were carried out under very simple conditions. Most of the more than 100,000 honorary observers were to watch for the mysterious portents that according to 3,000-year-old Chinese tradition were supposed to announce the coming of a catastrophic earthquake. The volunteers were constantly impressed with the importance of their task through flyers, lectures, personal instructions, school lessons, and radio broadcasts. Radio Tientsin, for example, broadcast the most vital information in the form of a dialog between Teacher Tung and young Red Guards,⁵ according to which the most widespread and most noticeable sign of an approaching great earthquake is "unusual behavior" of animals. With the use of numerous examples it was explained how animals would become excited, how they would signal their fears loudly, and that they would leave their burrows or try to break out of their stables. Also, the inexplicable clouding up of well waters and the appearance in them of bubbles and vile smells, sudden rises or drops in the groundwater level, and changes in temperature or chemical composition of the water were to be taken seriously as earthquake precursors. In addition, it was said that lightning bolts out of clear skies should not be overlooked, nor should lightning bolts coming from the ground. The latter, it was said, would appear as stripes, columns, or fireballs colored mostly red or blue. Also, strange noises coming from the ground, faraway growling thunder, or noises resembling those made by a moving tractor or by a storm could point to an imminent earthquake.

The efforts that had gone into the training of these many observers bore fruit: In the middle of December 1974 unusual animal behavior

was suddenly noticed in the Tantung area. Snakes came out of hibernation, crawled from their burrows, and froze to death on the snow-covered surface. Rats appeared in the open in large groups and were often so confused that they could be caught by hand. Cattle and fowl, too, were strangely excited. In the same area, and at the same time, the water in the springs became cloudy and frothy and the groundwater table changed.

A special session of the National Earthquake Bureau predicted that a small earthquake would happen north of where the big one was expected. It happened on December 22, 70 kilometers (45 miles) north of Haicheng. Immediately after this quake, preparations were made to evacuate and care for the people and to minimize property damage. Efforts to collect earthquake signs were intensified. Regular observation centers were set up at fowl-breeding stations, at ranches, and in those rural communes that had many animals. Throughout January 1975, reports of unusual animal behavior kept coming into the central bureaus. More than twenty species of animals, among them snakes, rats, chickens, dogs, cats, horses, deer, and tigers, were said to have been seized by fear. At the beginning of February the number of these reports suddenly climbed steeply. Increasingly it was the larger animals, such as cattle, horses, and pigs, that were panicking. Different animals expressed this differently. Geese flew into trees, dogs barked as if mad, pigs bit each other or dug beneath the fences of their sties, chickens refused to go into their coops, cattle tore their halters and ran away, and rats appeared and acted as if drunk. Even three well-trained police dogs acted beyond all recognition. They refused to obey their handlers, howled, and kept their noses close to the ground as if sniffing something out.²

Groundwater anomalies began spreading. The wells of the Ting-chiakou production brigade became artesian wells. Gas bubbles appeared in the pond water of the Shiaotze River Commune. The ice broke and water squirted up as if from a fountain. Dozens of other wells turned cloudy, foamed, and showed distinct changes in water quality.

A series of small earthquakes were detected in the first days of February. Their numbers rose quickly at first, but then gradually decreased through the fourth of the month. By then everything was ready. By 10 A.M. on February 4, there was no doubt in the minds of the experts that a big earthquake was imminent in the Haicheng area. By 2 P.M. evacuation was well underway. People were housed in previously prepared emergency shelters, animals were led from their stables, motor vehicles were parked away from buildings, and

valuables were removed from the buildings. To entertain the evacuated people and to keep their spirits high, movies were shown outdoors.

At 7:36 P.M. the anticipated earthquake finally came. It reached an intensity of 7.3 on the Richter scale. Worst hit was the area around the epicenter near Haicheng, where about half a million people lived. At least 50 percent of the buildings were either destroyed or severely damaged. Without timely evacuation, tens of thousands might have died. As it was, there were few victims. Most of those were people who had put too little faith in official earthquake predictions to put up with February temperatures outdoors. Some stubborn individuals were moved out of their houses and into the safe outdoors by force, official reports have revealed.

After the successful prediction of the Haicheng earthquake, a number of foreign commissions of experts tried to analyze the scientific reasons for this remarkable achievement. The most detailed examination has been that presented by the ten-member Liaoning Earthquake Study Delegation from the United States.² It was impossible in the aftermath to reconstruct the precise scientific logic of short-term earthquake prediction, but since long-term earthquake prediction cannot be applied to short-term prediction, and since the results of other geophysical measurements hardly suggested clearly identifiable processes that could be useful scientific earthquake predictors, only three phenomena remain as reasonable choices: the dramatic rise in the number of cases of abnormal animal behavior, the distinct changes in the groundwater level, and a swarm of small earthquakes that preceded the main event (a swarm whose greatest density was detected on the morning of the day of the earthquake). The preshocks alone could not have justified sounding an earthquake alarm, since they were indistinguishable from ordinary small quakes which often appear in swarms. Consequently, the many reports of observed anomalies in animal behavior and in wells must have played a big role in the final decision. Some Western scientists did not exclude altogether the possibility that the dramatic rise in reports of abnormal animal behavior and changed water levels in wells just before the Haicheng earthquake had been a manifestation of mass psychology without foundation in reality, but if that is the case the whole successful prediction of the severe earthquake remains a riddle.

In their discussions with foreign seismologists and in their scientific papers in Chinese journals, Chinese earthquake researchers leave no doubt that they believe in the phenomenon of anomalous animal behavior before earthquakes, even though they admit that they do not understand it. An elderly Chinese seismologist told the American

seismologist Clarence C. Allen of the California Institute of Technology that observation of animal behavior is “the best method for earthquake prediction thus far.” This opinion is reflected in the amount of space devoted to this phenomenon in Chinese earthquake literature. To understand its enigmatic manifestations better, I shall try in the following pages to trace it back into the remotest corners of the earth and into the early history of man.