

David Lubman with Brenda Kiser

**Ancient Echoes
THE ORIGINS OF SOUND SCULPTURES**

On my first visit to the Mayan ceremonial city of Chichén Itzá in January 1998, I discovered that an echo from the staircase of an ancient temple may prove to be, in effect, an intentional sound recording. I am an acoustical scientist and Chichén Itzá has long been known for acoustical anomalies, such as those reported on Wayne van Kirk's Web site "Mayan Ruins and Unexplained Acoustics". So, when I went on vacation in the northern Yucatan where the city's ruins are located, I took along some simple portable sound instruments and a digital tape recorder.

The site's most famous structure is its massive limestone temple in the form of a truncated pyramid. Named El Castillo (the Castle) by Spanish conquistadors arriving centuries after the Maya had mysteriously abandoned the city and returned to the Guatemalan jungles, the pyramid dominates the open, grass-covered plaza on which it resides. On each of its four sides a steep staircase leads up to a small temple on the summit. Two of these staircases are restored. Many climbers who reach the top find that the steps' unusually high risers and narrow treads make for a treacherous descent.

If you stand in front of El Castillo and clap your hands, you will hear a remarkable echo—a distinct chirp that swoops downward in pitch by almost an octave. Tour guides and tourists like to clap their hands to hear the echo, greatly annoying the archaeologists working there.

I stood in front of temple and, like other tourists, clapped my hands and marveled at the echo. Unlike other tourists who listened and promptly forgot, I sensed that this echo was more than just a "mystery" to tantalize tourists. I made tape recordings of the

initial impulse (the handclap) and the resulting chirped echo and noted the amazing similarity of this echo with the call of the sacred quetzal bird.

A normal echo is a delayed replica of the stimulus, or a series of delayed replicas. Experience tells us to expect the echo of a handclap to sound like a handclap, or a series of handclaps. But this echo sounds nothing at all like a handclap. It sounds tonal. Chordal is a better description than tonal, because the echo is rich in harmonics. (The presence of harmonics may surprise many scientifically trained readers, but it is true nonetheless. It is best understood by viewing the staircase as an acoustical diffraction grating). The echo, moreover, consists of a downward glissando, or gliding chord, that persists longer than the stimulating handclap's brief snap. The physics of the echo are simple to explain. Tonal echoes arise from periodic acoustic reflections from step faces. The early reflections are received from the lower steps and the late echoes are received from the higher steps. The pitch declines because the period between reflections becomes gradually longer for the higher steps.

Some have attempted to explain the steps' short tread by observing that the Maya are small people. That does not explain, however, why the stairs of other Mayan buildings have longer treads, nor does it explain the unusually high risers. Why then were the steps built to those dimensions and not another? Were the stairs of different dimensions, the echo would have not matched the frequencies of the quetzal song as closely as they do. Some archaeologists dismiss the echo as an artifact of reconstruction. Observing that the unreconstructed sides produce the same echo easily negates their claim.

Some tonal echoes are accidental. Mere design defects. But is it likely that the Mayan priests would have allowed a conspicuous and unwanted sound to remain at a sacred site? It seems more likely that the echo actually served a function. The Maya had a remarkably sophisticated knowledge of astronomy, architecture, and time, along with a highly developed mythology.

They were also literate and had developed a vast library of writings. Denounced as “superstitions and falsehoods of the devil” by the Spanish friar Diego de Landa in 1562, most of their books were consigned to the flames. Fortunately, a few manuscripts remain, along with a complex system of glyphs carved into buildings and stelae. Some of the glyphs have been translated. We know that the Maya named this pyramid the Temple of Kukulkan. The name of the Mayan god Kukulkan means “quetzal serpent,” “feathered serpent,” or “plumed serpent” and is the equivalent of the Toltec and Aztec god Quetzalcoatl.

At the spring equinox, an extraordinary natural light and shadow show graphically illustrates the temple’s name. Because of the building’s solar alignment, a zigzag or serpentine shadow cast by the pyramid’s edges slowly creeps down a balustrade as the sun rises. Archaeologists speculate that an annual ritual celebrating the feathered serpent took place at the equinox. Thousands may have filled the grassy plaza to watch the serpent shadow descend the staircase to the great carved serpent head at the bottom. In fact, thousands still flock to the site to experience the phenomenon.

The resplendent quetzal is a bird that the Maya believed to be sacred. This endangered bird, considered one of the most beautiful of tropical birds, is found only in Central America’s highland cloud forests. Immediately on returning home, I bought a CD

of could forest bird songs recorded in Costa Rica's Monteverde Cloud Forest Reserve. The recording included three types of quetzal vocalization: one of the bird in flight, one of a nest disturbance call, and one of its primary call. The quetzal's primary song as recorded on the CD was a downward chirp, uncannily like the pyramid's echo both in pattern and in pitch. I then created sonograms of the recorded echo and the quetzal chirp. While not exact, the two are very similar. Playing the two sounds in rapid succession to neutral listeners brought new reinforcement. A few were skeptical, but most were impressed and astonished by the similarity. Many were utterly convinced that the echo was a synthetic quetzal chirp.

But is this more than coincidence? Could the ancient Maya have deliberately constructed the pyramid steps to reproduce a birdcall? In order to make such a judgment, I had to learn more about the bird, its habits, and its place in Mayan life and religion, as well as how it came to be associated with the feathered serpent of Mayan legend.

The resplendent quetzal (*Pharomachrus mocinno*) belongs to the trogon family of tropical birds. Although its body is small, only fourteen inches long, the tail feathers (called coverts) of the male bird earn it the descriptor "resplendent." Trailing more than two feet behind the body, the four coverts shimmering brilliant iridescent green. The magnificence of these feathers made the bird precious as a valuable commodity to the ancient Mesoamericans, who considered them a symbol of wealth and power. Killing a quetzal was a crime punishable by death. Feathers were harvested from captured birds, which were then released. New feathers grew every year.

Itinerant vendors called *pochtecas* (merchants who lead) may have been Mesoamerica's first "feather merchants." They carried the feathers from the Guatemalan highlands to

lowland religious centers, including Chichén Itzá. In fact, quetzal feathers have been found as far north as New Mexico and as far south as the Andes. The *pochtecas* were more than traveling salesmen. They were members of a guild sworn to act with humility and modesty. They were explicitly forbidden from accumulating individual wealth or from displaying personal affluence. In the book *Bird of Life, Bird of Death*, author Jonathan Evan Maslow describes the merchants as a religious brotherhood devoted to spreading the cult of Quetzalcoatl.

The *pochtecas* carried stories about “the fabled feathered serpent, the brilliant green snake that lived in the sky and plunged to the earth,” says zoologist and author Dorothy Hinshaw Patent in her book *Quetzal: Sacred Bird of the Cloud Forest*. The association of the bird with the sacred feathered serpent of Mesoamerican legend was not arbitrary. The remarkable display exhibited by the male quetzal during its spring ritual mating flight may have given rise to the image of the flying serpent that rose to the heavens and then plunged to the earth. The Mayan inhabitants of the cloud forests must have known these vernal sights and sounds well.

Naturalist Thor Jansen, one of the few modern people lucky enough to witness the mating flight, wrote in his book *Quetzal* of seeing male quetzals shooting up vertically through the forest at sunrise, shimmering emerald green tail feathers streaming behind. When the birds reached several hundred feet above the forest canopy, they dove straight down vocalizing repeatedly. Their wings held close to their bodies while their converts undulated through the air, male quetzals gave the powerful appearance of flying serpents.

According to Patent, the bird symbolized unity between sky and earth, snake and bird, light and dark. From the quetzal comes the feathered serpent, “a sacred snake

cloaked in bright green feathers instead of scales, which unified these apparent opposites.”

The pyramids also reflected duality. They represented the ascent from *Tezcatlipoca* (the Toltec word for the jaguar, which symbolized death and darkness) to the light and wisdom of Kukulcan. They were stages on which priests performed their cosmic rituals for the people gathered below. Perhaps the priests standing in front of the pyramid steps clapped their hands and the great feathered serpent spoke in the voice of the quetzal that all would recognize. The ritual may have taken place at the time of the vernal equinox. Life triumphed yet again over death and darkness.

Myths and metaphors, such as the Mayan feathered serpent, help to define cultures. In a time beyond memory, our human ancestors first tried to understand their place in the world and in the vast cosmos. They created myths in which animals and birds, thunder, wind, and rain became metaphors for divine and eternal truths. From these myths and metaphors grew rituals that enabled the stories of the gods who resided above and below their world to be passed on to the next generation. The senses were their probes. They looked, they sniffed, they tasted, they touched.

They also listened. They naturally learned to interpret the sounds of birds and animals in subtle ways that modern people have forgotten. Unlike their modern descendents, our ancestors were still part of nature. The sounds of thunder, wind, and rain became attributes of the gods and personifications of their powers. Reverberations and echoes, such as those found in caves and other rock art sites, were voices of the earth speaking from another dimension.

Natural sounds found a place in ancient religions and myths. Not only were they a part of everyday reality, they constituted a language. Natural sounds were not noises to be disregarded or even to be enjoyed simply because of the pleasant ambience they created. The soundscape conveyed information useful to sustenance and important for survival. Sound became an important element of ritual. Drums and flutes and the human voice imitated elements of the soundscapes. Sounds used in ritual represented the gods that control nature, were intended to propitiate and even to imitate them. By imitating natural sounds, humans were beginning to control nature. Humans were becoming godlike.

Modern culture has blocked out the natural soundscape. The new urban soundscape is largely noise—unwanted sounds conveying little useful information. Solid walls and glass windows keep out the rain and wind and insulate us from the unwanted sounds of neighbors. Furthermore, by keeping the sounds of our household from being heard by our neighbors, the barriers ensure our privacy. Now, we are removed from the natural soundscape and sonically isolated from our human community.

Thanks to the adaptive abilities of the human auditory system, most urban people have learned to largely disregard the modern soundscape. Eyes rule. So it is understandable that archaeologists, too, disregard the soundscape. Archaeologists study disappeared cultures through material remains—bones and stones. Sound is ephemeral.

Archaeologists have supposed that ancients had no means like the stone and clay on which they recorded their stories to record the sounds that were important to them. They believe that they can never hear these ancient sounds or know how they were used.

Therefore, sound has not been considered a fruitful subject for archaeological study.

But even if there is reason to believe that the soundscape remains as the original inhabitants heard it, can we learn anything of ancient peoples' beliefs and culture from listening? I think so. We can only attempt to understand bygone cultures by understanding their beliefs in combination with the artifacts they left behind, including their soundscapes. Visual observation alone will not suffice. The ancient Maya left us an echo recorded in the stone steps of the Temple of Kukulkan. The sacred bird of like still sings. If only we learn again to listen.

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