The Acoustics of Ancient Theatres Conference
Patras, September 18-21, 2011

UNCANNY ACOUSTIC EFFECTS AT CHICHEN ITZA: INTENTIONAL DESIGN?

David Lubman

DL Acoustics, Westminster, CA, USA
e-mail: dlubman@dlacoustics.com

Abstract

Recent findings provide insight into ancient uses of sound for mind manipulation at Chichen Itza, Mexico, and suggest that ancient Maya builders were skilled theatrical designers. At the pyramid of Kukulkan, the echo of a handclap is transformed into the chirp of the *resplendent quetzal*, a bird venerated by the Maya since ancient times as the messenger of the gods. The transformation of handclaps into quetzal chirps at equinox ceremonies would support belief in the magical powers of their priests. The chirped echo was once dismissed by archaeologists as an artifact of reconstruction. But mounting evidence is now seen as supportive of intentional design. Chichen Itza's Great Ballcourt is located close to the pyramid of Kukulkan. Findings there also suggest that sound was engineered for mind manipulation. Great Ballcourt sound effects, however, are quite different, suggesting that ancient designers had a broad repertoire of acoustic design tricks. Used skillfully, the ballcourt's whispering gallery can produce mind-bending sound effects supportive of the ancient Maya mythology described in their best-known creation story, the *Popol Vuh*. Ballcourt sound effects include hallucinatory disembodied voices, shouting crowds, the whooping of an invisible bird flying rapidly through the ballcourt, and, with middling success, the sounds of growling jaguars and menacing rattlesnakes. Some of these effects seem supernatural even to modern listeners. In addition, the whispering gallery can be used as a public address system.

Keywords

Archaeology, Maya, chirp, echo, ballcourt

1. Introduction

This paper briefly describes unusual sound effects at two monuments at Chichen Itza: The temple of Kukulkan and the Great Ball Court. Archaeological and acoustical considerations suggest that the sounds now heard there are similar to those heard by the ancients. Moreover, these sounds held important meanings for the ancient Maya. Since both monuments were renovated in modern times, it's reasonable to ask if the sound effects heard today bear a necessary relation to those heard in ancient times. This writer believes that the modern and ancient sounds are similar. Thanks to extensive research on the Maya religion and culture, it is believed that sounds in ancient Maya ballcourts were noticed [1].

2. Spring equinox shadow at the temple of Kukulkan

The temple of Kukulkan has become famous destination for New Age pilgrims, tourists, and others at the spring equinox. In recent years, tens of thousands of New Age believers and others have assembled in the temple plaza to witness a light and shadow display on the pyramid that starts at the spring equinox (March 21) and lasts for several days. The phenomenon starts in late afternoon when a zigzag shadow that creeps down the west balustrade of the north staircase. Traditional modern Maya believe the shadow represents the seasonal descent of the Mesoamerican god Kukulkan from the heavens. The shadow can also be interpreted by Maya scholars as an avian transformation of the god Kukulkan from bird to serpent. (The spring equinox light and shadow show is the most famous of several astronomical alignments at the temple.) While the light and shadow show is entirely visual, in recent years visitors have added a sonic element by engaging in synchronized sustained rhythmic clapping.

Figure 1 – (Left) Temple of Kukulkan exhibiting Spring Equinox "serpent shadow"
Figure 2 - (Right) Resplendant quetzla, thought to have inspired that shadow

The clapping evokes a chirp-like echo from temple staircases that is heard throughout the plaza. The archaeological and cultural significance of the chirped echo sound, first recognized and explained by the author in 1998. [2-6, 8] This paper emphasizes the subjective experience of listeners rather than acoustical engineering.

2.1 Chirped echo from temple staircases

Many visitors in the open plaza standing before the temple of Kukulkan notice this unusual sonic effect upon clapping their hands. The sound actually consists of multiple echoes (scattering) from a temple staircase, but is heard as a monotonic downward chirp. Its sound is audibly unlike the sound of the stimulating handclap. Not all visitors notice the anomalous echo. But many of those that do notice are astonished - as they should be, since the echo violates their lifelong listening experience and expectation.

2.2 Why the chirped echo is unexpected

Like most people, the surprised visitors learned early and wordlessly to expect echoes to be delayed replicas of their stimuli. In other words, one expects the echo of a handclap to sound like that handclap. Because ordinary echoes meet that expectation they are taken pretty much in stride. Not so the chirped echo. Many first-time visitors to Chichen Itza find the chirped echo totally unexpected and cannot explain why.

2.3 The chirped echo seems uncanny or even supernatural to some listeners

Persuasive scientific explanations for this effect are now available [5]. But to many listeners, it seems unnatural, even supernatural, for a sound stimulus and its echo to sound radically different. It is as if one's handclap is answered not by an echo but by an unseen sentient being. Anecdotal evidence suggests that hearing the handclap echo can evoke numinous (spiritual or spooky) responses. One may also use the term "uncanny", because it seems to be a sonic expression of Sigmund Freud's idea of "the uncanny" published in his 1919 book by that title [7].

2.4 Maya cultural connection with the chirped echo

Transforming handclaps to chirps is remarkable. But there is another surprise. The chirp sounds very much like a bird that had an important place in the ancient Maya religion. The chirped echo's sonogram seems closely matched to the chirp of the *resplendent quetzal*, a bird venerated by the Maya since ancient times as messenger of the gods. It seems plausible to designate a bird intermediary between man and the gods, since birds traffic between the "middle world" of daily experience and the "upper world" or heavens, thought by the Maya and other cultures to be a dwelling place of their gods.

It would make great theater if in ancient times the priests exploited the ability to produce quetzal sounds at will. Imagine a well-attended spring equinox ceremony at the temple of Kukulkan at which a manipulative priest asks a question of the gods, then claps his hands. The transformation of handclaps into quetzal chirps at equinox ceremonies would reinforce belief in the magical powers of the priests. The Maya faithful would probably recognize that the handclap sound emanated from a priest and the quetzal sound emanated from the temple. It would appear that the priest's aural inquiry was immediately rewarded with an aural answer from the gods relayed by the quetzal, the messenger of the gods.

But what did the chirped answer mean? We speculate that only the priests, acting as oracles, knew how to translate the chirped answer into the local language. Although

the Maya had their own oracle tradition: *Chilanes*, literally 'mouthpieces' of the deity, this speculation recalls the ancient oracle tradition of Greek antiquity. The following is an abbreviated excerpt from Wikipedia's entry on the Oracle at Delphi.

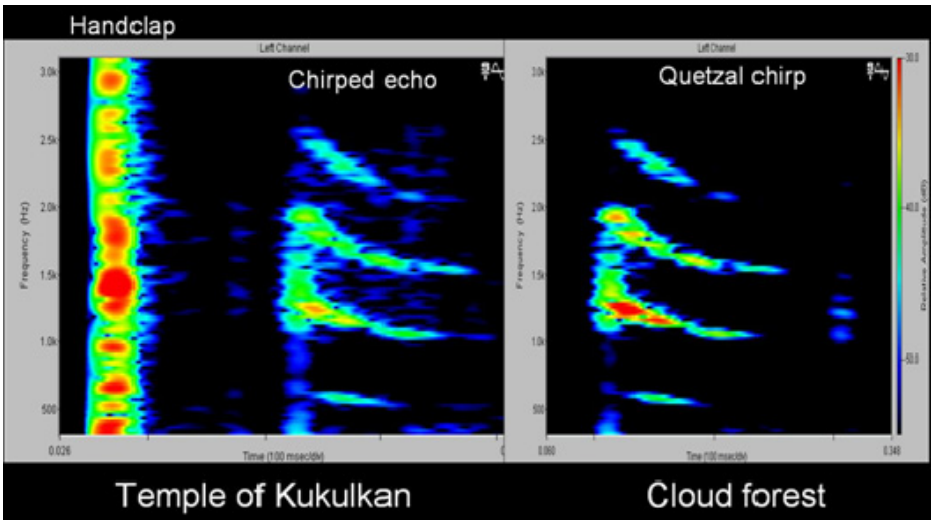

Figure 3 - Sonograms of the chirped echo of a handclap recorded at the temple of Kukulkan (left) and a quetzal chirp recorded in the cloud forest (right) The vertical stripe on the left is the handclap sonogram and may be ignored for present purposes

3. Oracle at Delphi (from Wikipedia)

"In Classical Antiquity, an **oracle** was a person or agency considered to be a source of wise counsel or prophetic opinion, predictions or precognition of the future, inspired by the gods. As such it is a form of divination."

"The word is derived from the Latin verb *ōrāre* "to speak" and properly refers to the priest or priestess uttering the prediction. In extended use, *oracle* may also refer to the site of the oracle, and to the oracular utterances themselves, called *khrēsmoi* (χρησμοί) in Greek."

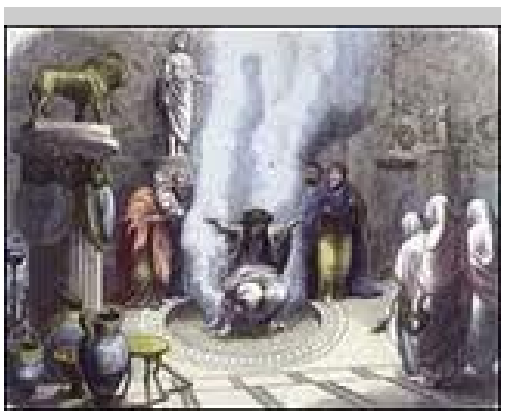

Figure 4 - (Left) Remains of the Delphic Oracle site on Mt. Parnassas, Greece.
Figure 5 - (Right) An interpretive painting of the Pythia (priestess) seated on a tripod and breathing volcanic vapors to achieve the ecstatic state necessary to produce the oracle.

"Oracles were thought to be portals through which the gods spoke directly to man. In this sense they were different from seers (*manteis*, μάντεις) who interpreted signs sent by the gods through bird signs, animal entrails, and other various methods."

"The Pythia, when about to deliver, would chew leaves from Apollo's sacred laurel tree and would then sit on her holy tripod, seated in the innermost sanctum, over a crack on the rock from where noxious volcanic fumes emanated. Dazed and disoriented, she would then be "possessed by the voice of Apollo" and utter inarticulate sounds before fainting. Only the priests were present there, and they had the task of "translating" her utterances in plain speech."

4. Sound effects in the Great Ballcourt

Chichen Itza's Great Ballcourt (GBC) is located close to the temple of Kukulkan. Findings there also suggest that sound was engineered for mind manipulation. Some seem supportive of the ancient Maya mythology described in their best-known creation story, the *Popol Vuh*. Unlike the chirped echo at the temple of Kukulkan, GBC sound effects, are quite varied, suggesting that ancient sound designers had a broad repertoire of acoustic design tricks. The Mesoamerican ballgame is the oldest known team sport. It has been described as "the game of life and death". That may explain why some of the known sound effects seem to inspire fear or danger. GBC sound effects include hallucinatory disembodied voices, shouting crowds, the whooping of an invisible bird flying rapidly through the ballcourt, and, with middling success, the sounds of growling jaguars and menacing rattlesnakes. Some of these effects seem supernatural even to modern listeners. The author believes that other sound effects that may have been used in ancient times remain undiscovered.

4.1 The whispering gallery and its public address capabilities

The GBC also has a unique whispering gallery that, when used skillfully, can also produce a variety of mind-bending sound effects. The best known whispering gallery effect is that persons standing on either of two end-temples outside the playing field about 540 ft. apart can communicate successfully using normal or slightly elevated voice levels. Technical analysis suggests that the whispering gallery effect increase voice levels by about 20 dB over inverse square law predictions [8].

Less well-known is that a person located on either temple has excellent two-way voice communication with persons in the playing field. It would have seemed supernatural for person on the playing field to hear disembodied voices when no one else was visibly present. The same effect could be used to permit persons (officials?) located on end temples to speak to or eavesdrop on persons in the playing field. Technical analysis suggests that the effects were even stronger when the temples were intact and its sound reflecting surfaces were freshly plastered.

In addition, the whispering gallery can be used as a public address system. A person standing on either end temple could communicate with an assembled multitude in the playing field. This would be a useful tool enabling kings and priests to address subjects.

The whispering gallery was first noticed by the excavating archaeologist, Sylvanus Morley. He reported that the whispering gallery's strength increased as the excavation

proceeded. In modern times the GBC has sometimes been used for public performances. But archaeologists seem to have ignored its presence and cultural implications.

Fig 6 - Recent photo of Great Ball Court. Notice the two end temples are located on the center line and are not in physical contact with the two long parallel walls of the playing field. The walls are 28 ft. tall and 278 ft. long, precisely parallel, and highly sound reflective.

5. Conclusions

Archaeoacoustics seems to have become an accepted science. The history of its acceptance parallels the now-accepted field of archaeoastronomy. The problem it faces is that archaeological scholars appear to be visually dominated and so ignore evidence of ancient uses of sound. While this paper focused on the Maya culture, examples of sound use in other cultures are being discovered.

References

[1] S. Houston & K. Taube, Cambridge Archaeological Journal 10:2 (2000) 261-94
[2] D. Lubman, "Physical explanation and mythological hypothesis for the chirped echoes resounding from the pyramid staircase at Chichen Itza". V Mexican Conference on Acoustics, Querrtera, QRO., Mexico. September 1998.
[3] D. Lubman, "Maya acoustics: Of rainbows and resplendent quetzals", J. Acoust. Soc. Am., **26** (4), 2285, (A) (1999).
[4] D. Lubman, "Acoustical features of two Mayan monuments at Chichen Itza: Accident or design?" J. Acoust. Soc. Am., **112** (5), 2285, (A) (2002).
[5] Sounds and sonograms of bird and echoes at http//www.ocasa.org/membersites.htm
[6] D. Lubman, "Convolution-scattering model for staircase echoes at the temple of Kukulkan", Proceedings of Acoustics, 08, Paris, June 2008.
[7] S. Freud, "The Uncanny", first published in 1919 in *Imago* 5 (5-6). English translation first published by Penguin Books (UK) 2003. Translation by David McLintock.
[8] D. Lubman, "Sound Magic: The Great Ball Court at Chichen Itza, Mexico" 4th Joint Meeting, Acoustical Societies of America and Japan, Honolulu, HI, Dec, 2006.