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SENDING MEANING ACROSS EPOCHS

WE READ messages everywhere, even when there aren't any.

Every known culture perceives constellations and stories in the stars. We see faces where there are none, in the chance roiling of clouds, the dark lava features of our moon, or the erosion patterns of a mountain on Mars.

We also read buildings. No architecture stands independent of aesthetics. "Beauty" changes with time, so that buildings once considered masterful are often demoted and even demolished.

This High Church defense, then, depends on how long one thinks a given cultural preference shall reign. By High Church, I mean striving to pass on the elite culture of the time -- the best art, jewelry, and so on. Ruling classes do this throughout history. Future Kilroys lie in wait to scrawl Kilroy Was Here on the finest durable works of their time. As urban planners know, the first signs that a neighborhood is beginning to slide are graffiti. The fact that NASA now attaches disks loaded with signatures of the public to every outbound spacecraft is not reassuring in this regard.

Those works considered beautiful can even ignore structural rules. The Athenians converted a wooden temple into a stone one, disregarding the vastly different demands of the transition, yet creating the marvel of the Parthenon.

Architecture conveys many nonverbal, or semiotic messages: consider the barred windows of a jail versus the ornamented, status-rich windows of a Renaissance palace. Semiotic meanings are deeply cultural and time shapes them. The pyramids once sent a religious message, later a magical one, still later an engineering one; today we see them mostly through a lens that combines artistic, structural and sociological ideas.

Still, they have great power. Doomed nuclear-war survivors in Nevil Shute's *On the Beach* spend their last days constructing one in the Australian desert, a monument with no future audience, since humanity is dying; yet they build.

But some themes seem embedded even more deeply in the way we see our world. From the tension in a rope pulling a bucket from a well we intuit tensile properties. These then inform our way of looking at a suspension bridge, surely the most elegant combination of function and form in our time. Semiotic messages satisfy us best when we understand them both structurally and aesthetically.

A sense of wrongness can also be deeply intuitive. A tree trunk and branches tells us, by analogy, about gravity loads in tall buildings, adding from top to bottom. Violating this intuition brings a sense of error or ugliness. We stand puzzled before Cretan columns, which thicken as they rise, but accept Doric

columns which are widest at the base. Cantilever beams which thin toward the tip are right to us, while a beam broader at the tip strikes us as wrong.

The Cheops pyramid reminds us awesomely of a mountain, but a building of inverted, truncated pyramid design says to us that some trick has been played to give an unnatural result. We get an uneasy surprise from glimpsing one on the horizon, of "dishonest" design.

Scale does not seem to impede semiotic messages. Spiderwebs and the Golden Gate Bridge alike call forth our perception of tensile structure, their lightness striking us as obviously elegant.

Yet semiotic readings can change quickly. The Eiffel Tower was vigorously opposed and originally slated to be torn down after the exhibition it ornamented was over. Within a generation this "monstrosity" had become the very symbol of Paris and France itself. It attained this glory by conceding almost nothing to decoration, revealing its sinews completely, like a vertical suspension bridge.

Perhaps the most reliable wordless message to send across the millennia is awe. To instill this mingling of fear and wonder leaves the visitor with a memory free of words or detail. Though this is a High Church approach, fear can be part of the effect: the convergence of awe with the awful. Many have seen something fleetingly terrible in the visage of the Sphinx.

Ancient things and places hold inherent wonder for us because they speak to deep aesthetic biases we share. The most striking of obvious markers hold a still and subtle balance that their makers carefully shaped, speaking across time in the language of beauty. Ancient cultures fell in line with nature, many of their most obvious markers (pyramids, astronomically aligned henges) comprising a vast, unvoiced aspiration to join in harmony with elemental forces. Their stones speak to us still.

Next to the Egyptian pyramids, Stonehenge seems the best known example of this. Somehow this ring of stones instills wonder, though at first glance it is not very impressive to some. John Fowles in *The Enigma of Stonehenge* (1980) quotes a child saying worriedly, "Why are there so many doors?" To the untutored eye it seems easy to see in it a mere lot of doorways leading nowhere.

Like the several hundred "hengese" in Britain, its true purpose is unknown. Plainly it meant much to the ancient laborers who dressed the huge stones, moved them many miles, pounded them level and true with mauls. Their sarsen stone is three times harder to work than granite, able to ruin the edge of most modern tools short of steel alloy. Though the site slopes several feet east to west, the tops of the lintels vary by only three inches, after millennia of settling. Engineers estimate that about half a million man-hours went into simply digging the ditches and banks of the area.

Explanations of its geometry revolve about astronomy; photos of it invariably portray the sun rising or setting between uprights and a lintel. To the modern mind, which rarely notes the rise of the sun nor of stars, the astronomical role

is not intuitive.

Millions today know their birth-sign, but because the stars have moved since the Babylonians invented the Zodiac, most of them have it wrong. Such people may find it difficult to conceive of a passionate interest in getting the winter solstice, say, exactly right, as viewed through a ritual stonework.

Still, the henges seem to focus lines of sight and to shut out glare; they are more like sun-visors than doorways. Even copies, such as the exact Stonehenge replica beside the Columbia River in Washington State (built, oddly, as a memorial to the World War I dead), capture this reverential flavor.

Stonehenge itself was an observatory, not in our modern sense of a place to discover the new, but rather, a site to embody knowledge of the sky won over centuries, if not millennia, and already old. The strength of conviction demanded to inspire such awesome labors, constructing an entire complex of henges (Avebury and Woodhenge lie nearby), all to reflect an understanding of our universe as revealed in the sky, is difficult for us to fathom. This underscores the immense cultural gulf that deep time messages must span, and so seldom do.

Even though awestruck, we do note geometrical messages, some no doubt unconsciously. Stonehenge's central stones form an oval as seen from above. The lengths of the two oval axes are in the ratio 5:3; this is close to the Golden Section, 1.6280..., a number of great import to the ancient Greeks. Such deep aesthetics can cross cultures.

It is also worth noting that the perimeter of the Great Pyramid, divided by its height, is 2 Pi, so the height was set to equal the radius. The symbol of the sun God Ra was a circle, so when Ra rose at morning the pyramid greeted him with a geometric analog of himself, a hailing call from his subjects.

Such mathematical clues play to perceptions free of words and sentences. The Golden Section is a preferred number in the aesthetics of many different cultures. That these predilections appear to come down to us intuitively, while we must endlessly speculate on the true intentions of the Stonehenge builders, suggests that some very rarefied messages can persist.

Great monuments also seek to carry messages through the ancient language of mass. Bulk alone can draw our attention. Texts like the Bible carry messages through a hardening of an existing culture, protecting the text itself from tampering or extinction.

This desire to convey some essence of ourselves, whether High Church or Kilroy Was Here, is the great impulse behind deep time messages. But there is also a clear desire to shape the future, and to use the idea of the future to shape the present. Many legacies stem from this desire.

TIME CAPSULES

The universal human urge to bury the dead, often with accompanying objects, may stem from the agricultural experience of burying a seed and seeing a specific plant grow later. But Neanderthals' careful grave burials belie this easy explanation, though quite possibly the impulse behind human burials is to invoke the resurrection we see in nature each spring.

In this sense some deep time messages play to this "natural" predisposition. The storage and replanting of seeds is a Jungian archetype. But long-time marking of radioactive waste sites is anti-archetypal, since we are planting not life but anti-life, poison. Rather than say the "right" thing ("Take my husband, Crag, who lived a good life and deserves mercy"), our waste site markers must proclaim "Stay away, danger!"

We have learned much from ancient burials. Intentional grave sites are often High Church, providing the deceased with some supplies for the afterlife, or artistically decorating casket, sarcophagus, crypt or tomb. Inadvertent burials can tell us much more, as with the chance discovery of a man covered by ice for 5,300 years in the Austrian-Italian Alps.

This unique find brought us a body well preserved and carrying its microorganisms and parasites, his working tools (bows, arrows, dagger, axe), and clothes. Apparently caught in a sudden storm, his is the best permafrost mummy ever found, a trove of clues to a society and time that left no written records.

Bodies can even give us enough clues to reconstruct plausible features, literally giving faces to the past, as in a striking depiction of Alexander's father from an 8 B.C. Macedonian grave site. Science can pluck subtle clues from apparent ruin, making time capsules from accidents. Whole cities flooded by lava, such as Pompeii and Heraculaneum, provide us with encased bodies and buildings, invaluable archaeological troves. As science advances, most deep time messages will be inadvertant, pulled out of history's noise level.

Time capsules embody a modern faith in a future that will care about us, underpinned by our anxiety that our most cherished beliefs and customs may be unintelligible, meaningless. Cities and institutions, no less than whole nations, have solemnly buried memorabilia, with much accompanying ceremony. The Order of Masons' cornerstone-laying ceremonies may have started this modern practice; in 1793 George Washington, a Mason, laid the original cornerstone of the U.S. Capitol, which may have held artifacts and has since been lost.

Roughly ten thousand time capsules already await future historians. Notably, their time horizon is quite short, usually a century. Citizens of Sandusky, Ohio, will presumably gather to open a capsule laid down only fifty years before, though, filled with objects which recall "the triumphs and tragedies of life in America during 1995." These include Pop-Tarts, crayons, the May 29, 1995, Newsweek, a "Buns of Steel" video and a Wonderbra. In 2043 Euclid, Ohio, presumably will dig up a seven-foot torpedo tube packed with a history of town organizations including the Polka Hall of Fame and a "Not Too Young to Polka" cassette.

The Seville World's Fair of 1992 left an interesting democratic variation: the Capsula de Tiempo, an open tar pit into which anyone can throw whatever they wish. This cavalier style, advertised as "democratic," contrasts with the World's Fair of 1939 tube of copper, chromium and silver, "deemed capable of resisting the effects of time for 5,000 years." It was the first to be called a time capsule, though its first name was "time bomb" since some believed its opening in 6936 A.D. would set off a cultural explosion, with its textiles and microfilm, TV set and a machine that teaches English.

For the U.S. Bicentennial, President Ford had 22,000,000 citizen signatures collected for interment at Valley Forge, intending them for study in 2076. Proudly toured throughout the nation for display, the capsule was however stolen from a van at the burial site.

This is another common theme: slips between cup and lip. Many capsules are already lost, their markers not erected, details of location forgotten. The city of Corona, California, has already laid down seventeen capsules (one of which I saw solemnly interred in 1963) over the last half century, only to lose track of them all, though they did tear up a lot of concrete around the civic center in a fruitless search. The cast of the M*A*S*H TV show buried a priceless set of tapes of the show, plus artifacts, somewhere in the 20th Century Fox parking lot in Hollywood, but nobody knows just where. Though buried only in 1983, it is already submerged beneath a huge Marriott hotel.

A 1953 two-ton capsule mandated by the state of Washington lies lost beneath the capitol grounds because during political infighting the legislature did not fund the last act, its marker. People can recall the ceremony, but not precisely where it was held.

The approach of the millennium has caused a boom in time capsules; there is even a company producing custom-engraved aluminum tubes. They seem designed to last at best a few centuries. Capsules are usually gestures of more importance to their planners than anyone else. The pop artist Andy Warhol filled 608 packing boxes between 1974 and 1987 with inexplicable memorabilia, ranging from unknown paintings to telephone messages, check stubs, and a piece of cake. He intended this trove for some permanent capsule, but never built it. In 1997, Pittsburgh's Warhol museum paid tribute to him by laying down another capsule assembled from whatever local residents brought in. As engineers put it, the signal to noise ratio here seems low.

Some capsule designers take the longer view. Oglethorpe University in Atlanta sealed a Crypt of Civilization in 1940, not to be reopened until 8113. (This date is as far from 1940 as were the earliest dated writings then known.)

The Crypt was devised by Thornwell Jacobs, who began the academic pursuit of time capsules with an article in Scientific American in 1936. He was impressed by a capsule buried by Tokyo citizens, to carry forward the names of 10,000 victims of a 1923 earthquake. Far greater disasters have befallen this century, so this tragedy and its Kilroy capsule now seem eclipsed as they lie in quartz jars beneath a Buddhist temple.

Oglethorpe houses the International Time Capsule Society, and its Crypt is indeed vast, the size of a swimming pool. It contains microfilmed books "on every subject of importance known to mankind," artifacts dealing with six millennia of history, the inevitable photos and wire recordings of world leaders circa 1940 (already mostly forgotten), and a quart of Budweiser. The designer apparently felt that much would change, but not beer, though it seems an uncertain sort of Rosetta stone. Perhaps it will be reassuring to the openers in 8113 to find that this Bud's for them (though it will be flat), but it is unclear how anyone will know when to open the repository itself.

This is a classic dilemma of deep time: safely buried, how does the object announce itself to its intended audience?

As the Vatican well knows, preserving a capsule, marker or message by creating an attendant culture can work over millennia. Ancient religious sites such as Mecca transmit with high fidelity their central tenets, perhaps more concretely than their sacred texts, which can be Bowdlerized or reinterpreted, since they rely on perishable parchment or paper.

Still, no institution comes down to us intact from the vast era before the invention of writing. This is no accident; text carries so much information, it can knit together whole communities. Perhaps the success of the Catholic Church stems in part from its deep urge to copy old manuscripts, which served it well a millennium ago.

It seems unlikely that one could build such a devout community today, short of launching a new religion. In Osaka, Japan, a group plans to bury in 2001, atop Mount Fuji in Antarctica, a master time capsule housing biological samples; apparently they feel that isolation is the best defense.

Suggestions that nuclear waste sites be cared for by an "atomic priesthood" ignore the motivations of the priests. It seems difficult to imbue groups with the dedication to spread superstitions about spots having "bad juju." Skepticism suggests that some future Age of Enlightenment would spawn freethinking types who would venture into the sites to prove that the priesthood was full of baloney.

Still, the rise of mass celebrations could conceivably lead to such a community. The current Burning Man assembly in the desert near the Nevada-California border, dedicated to torching a tall wooden statue every year, echoes the Celtic wicker man ritual, but seems unlikely to convey any durable message, though cultural critic Stewart Brand has at least ventured the idea.

Brand and others have founded The Long Now Foundation, which seeks to leave an enduring clock and library, perhaps with a community to support it, probably in the Nevada-California desert. A clock marking off millennia could inspire long-term thinking, though how can anyone both make it public and protect it? With a nonsecular priesthood?

Brand cites an arresting fact: The oak beams in the College Hall of New College, Oxford, needed replacing in the nineteenth century, so the College cut down some oaks planted in 1386 for that express purpose. In our modern time-pressed lives, does any organization, even New College, plant or plan for such perspectives?

Bits can last better than mass; strong belief systems have weathered from antiquity, principally as religions or philosophies. The cohesion of the Jews is legendary. The Pharaohs' priesthood lasted millennia, and New College's faith in the continuity of English culture is striking to us in our helter-skelter times. We could ape such deep time strategies. But how to inspire a priesthood? Modern times have been full of convictions, many strongly felt (Communism, Fascism, Socialism) and short of span -- but it is not an age of faith.

At the end of our millennium we face a particular problem: the rate of change drives short-term thinking, but as our powers increase, our problems become longer-term. Environmental impacts are the best example. Meanwhile our principal tool, technology, is moving toward the transient and small.

Our modern sense of the technological sublime stems from fresh sensations of size, speed, sound, and novelty. Big things compel attention, as always; even better if they are loud and fast and new. The Apollo V rocket fits all of these.

Our newest technological marvels are relentlessly small and quiet, however, from ever more compact computers to genetic engineering feats. When Arthur C. Clarke picked the microchip as a recent wonder, his response was intellectual, not visceral. Speed, compactness, and novelty are passing wonders. Again, stone is the best deep time investment.

Unlike the Hoover Dam, which was designed to last two thousand years (and has impressive symbolic star-chart time markers which could be read over that time), the late twentieth century leaves few impressive techno-marvels. The High Aswan Dam and China's Yellow River Dam carry no notable messages. The millennial fever surrounding 2001 comes in an age more time-obsessed than any, but whose latest technology seems particularly inappropriate for deep time messages.

Still, one could bury a time capsule and hope for the best. Once only kings could marshal durable deep time messages. Now we all can at least try.

In my next column I shall deal with the many ways we are attempting to leave markers to endure through centuries, and what they reveal about us.

Some of this column appears also in Dr. Benford's new book, *Deep Time*. Comments and objections to this column are welcome. Please send them to Gregory Benford, Physics Department, Univ. Calif., Irvine, CA 92717. Email: gbenford@uci.edu