Chapter 7

Geoglyphs to the Gods

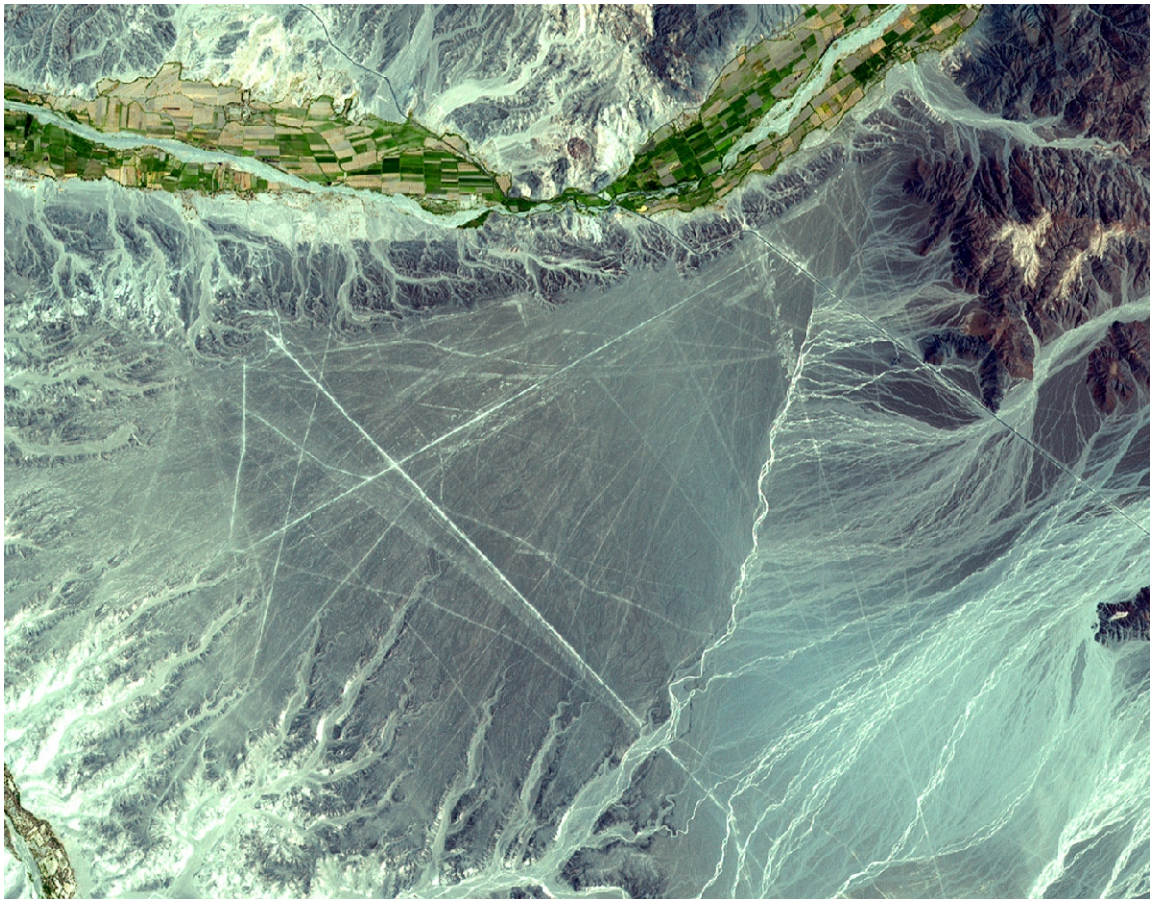
Life, Death, Water and Geometry

The driest location on the face of the earth is the high pampas of Nazca just inland from the south central coast of Peru. Bleak and uncluttered by plants this red-brown terrain receives less than an inch of rain per year. It is a land where the desiccated mummies of ancient Peruvians are still being discovered, preserved by the record dry climate.

Plants enter the arid sand and gravel of the Nazca plateau at their own risk. The interface between life and death is stark on these arid plains – it is the site of many pre-Inca cemeteries. Some "burials" keep the deceased in full-view, as with this still clothed 2500-year-old mummy.

The ground at Nazca is relatively high in iron. Its dark sienna color is the result of eons of exposure to oxygen rusting the iron at the surface. Kick away a bit of the surface and, where the rust has not reached, the ground is light yellow ochre.

Nazcans of the 4th and 5th century BC found that they could fairly easily take advantage of the contrast between the darker sienna and the lighter ochre to draw gigantic patterns and images on the pampas. They simply raked away the surface rubble to reveal the lighter undersurface, thereby crafting broad stark lines across the ground. The lack of storms keeps the raked material in place and the extreme dryness slows the oxidation of the exposed earth. The drawings remain intact for many centuries.



Above: The most numerous of the markings raked into the red gravel of the Pampas Colorado are the seemingly random lines crisscrossing the plateau's gullies and washes. Some of the lines run for miles without wavering and are clearly visible in this satellite image. Early theories held that these lines were aligned astronomically. Later a computer analysis discounted these theories, proving the lines to be random with respect to major solar, lunar and stellar events.

Right: A close up of the pampas' surface reveals a sprinkling of coarse, darkly oxidized gravel over a sandier under-layer. Brushing away the gravel brings out the lighter color of the sand and provides the contrast necessary to execute the geoglyphs.

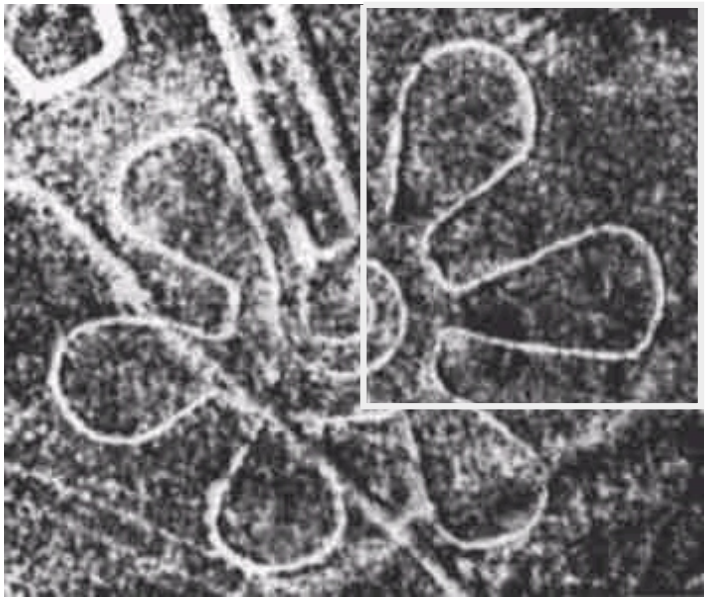
The images are fascinating and curious. Seventy geoglyphs, some as large as 700 feet across, spread across over 500 square kilometers of the Pampas Colorado. Most represent animals whose normal habitats are the water-laden environments of the Pacific coast or the Amazonian rain forest.

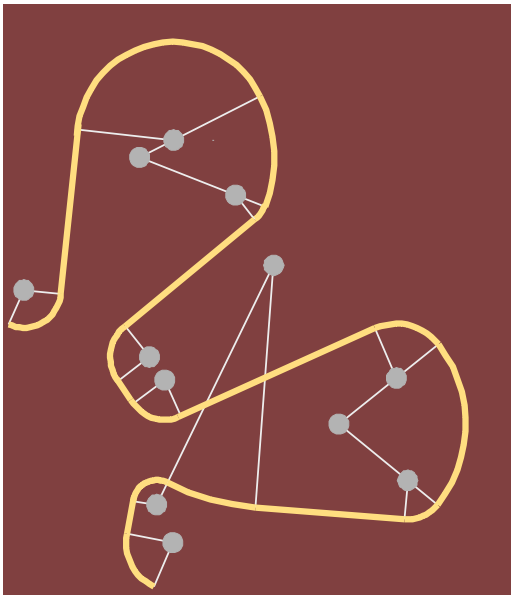
Two of the glyphs, a spider and a monkey, appear to represent species native only to the Amazon. Another depicts a hummingbird, miles away from any living flower; yet another is of a whale spewing water from its blowhole.

Though its image is drawn on the high, dry Pampas Colorado the spider monkey is arboreal and resides a few hundred kilometers to the east in the rain forest of the Amazon. Some kilometers to the west whales cavort along the Pacific coast of Peru. Based on the spume erupting from the fish-shaped glyph the artist/engineer has captured one of these whales in action.

This wet-world iconography superimposed on the driest of geographies suggests that the images may have served a magical/religious function in divining for water.

Furthering this notion of a magical purpose is the strange juxtaposition of crude drawing and sophisticated engineering that formed these mega-drawings. A preponderance of archaeological and anthropological evidence – chiefly in the artifacts uncovered in the graves dotting the pampas – points to the Nazcans as a shamanistic society: one whose spiritual leader, the shaman, could self-induce trances in order to commune with gods and spirits.





Left: The six petals of this glyph depict a somewhat asymmetric and mal-proportioned flower. Despite this their layout demonstrates exacting geometry.

Right: In order to keep the monumental drawings faithful to the original working drawing Nazcan engineers applied significant geometric skills, perhaps developed as they built aqueducts for their water supply. This sampling of two of the flower's petals reveals the radial lines and arc centers used in their construction.

Shamans often revealed their trance journeys with stories and portrayed their visions with drawings. Apparently the Nazcan shamans took their revelations one step further and passed these drawn visions on to an engineer to scale up and translate onto the earth. The engineer did so, compelled to convey every clumsy turn and lumpish curve of the shaman's unconscious drawing lest he lose the drawing's magical efficacy.

In order to achieve this the Nazcan geometry used the principle of tangent continuity. Every twist and turn of the inspired drawing was broken down into a series of arc and line segments and constructed to maintain a precisely tangent relationship from arc to arc and arc to line. The Nazcan engineer knew to apply two important geometric relationships in order to create continuity between the segments: 1) that two tangent arcs share the same

Tire tracks of inconsiderate tourists wreak permanent damage to the pampas' fragile surface. This geoglyph of an Amazonian spider has been luckier than many of the images, some of which have been destroyed. Ironically, the tracks reveal the same geometry as that used to construct the geoglyphs: they move smoothly from lines to arcs determined by the turning radii set as drivers steer their vehicles.

radius line at the point of tangency and 2) that a line tangent to an arc runs perpendicular to the arc radius at the point of tangency.

Maria Reiche, a German mathematician and self-trained archaeologist who carried out the definitive study of the Nazca lines, proposed this method of construction. Upon field checking her theory against the actual geoglyphs, Reiche discovered a stone, distinctly larger than the surrounding stones, marking the center of each connecting arc of the figures.

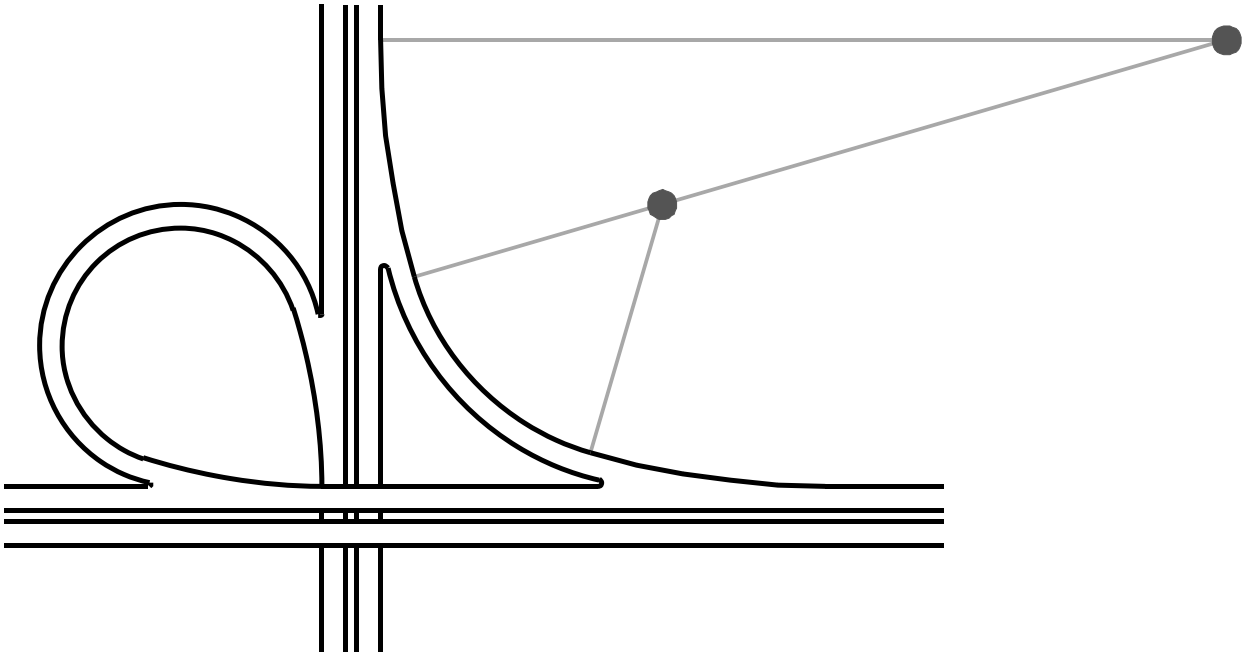
Transportation, Trade, Water and Geometry

The ancient Nazcans built aqueducts to bring water from the surrounding mountains to their desert capital. Similarly Importation of water has opened the deserts of the Western United States to commerce and development. Modern geoglyphs, engineered of asphalt, smoothly abet transportation, trade and growth.

It was not until the development of air travel in the1920's that the modern world crossed paths with the Colorado pampas' ancient lines. Referred to in Spanish reports from around 1600, the lines were first scientifically noted in 1926 by Peruvian archaeologist Julio Tello and surveyed in 1941 by American scientist Paul Kosok. Serving as Kosok's translator, Reiche took over study of the lines until her death in 1998.

In the meantime modern civilization built a significant line of its own several thousand miles long, part of which traversed the Nazca plateau. In the 1950's completion of the Peruvian leg of the Pan-American highway brought travelers to the art of the ancient Peruvian shamans. Unfortunately many drivers left the highway. Parallel lines of tire tracks began pocking the gravel skin of the pampas and, like the original lines, destined to last for centuries.

Highways may be the "geoglyphs" of the automobile age. Engineered with the same geometry as the figures at Nazca, highways need to preserve continuity for reasons of speed and safety rather than aesthetics (although aesthetics can certainly be a by-product). In the case of highway building tangent continuity prevents abrupt changes in direction and enables gradual, flowing change. Same geometry different gods.



All horizontal curves on highways are circular arcs and maintain continuity by changing radius at tangent points. Though much simplified this expressway interchange design exemplifies the matching of a curve's radius to the likely velocity and direction of vehicles. In order allow transition from higher to lower speeds as the driver exits a broad curve veers from the highspeed straightaway into a tighter curve. The curve again broadens letting the driver accelerate into the flow of traffic on the intersecting expressway.