**DISCOVER MAGAZINE 2017**

The Inka Empire Recorded Their World In Knotted Cords Called Khipu. The great South American civilization used complex knots and fibers for record-keeping and communication (2017): Zitieren und Belegen von Literatur in wissenschaftlichen Arbeiten. <http://discovermagazine.com/2017/oct/unraveling-a-secret> (17.10.2019).

<https://www.discovermagazine.com/planet-earth/the-inka-empire-recorded-their-world-in-knotted-cords-called-khipu>

High in the Peruvian Andes, in the remote village of San Juan de Collata, sits a wooden box that’s sacred to the locals who keep close guard over it. It contains 487 cords of twisted and dyed animal fibers that, according to its caretakers, **encode messages planning an 18th-century rebellion.**

Anthropologist Sabine Hyland was invited by community members to study the strings — the first outsider permitted to view them — but only for 48 hours and under constant supervision.

Although no one alive today can decipher the cords, **their general message and significance has been passed down orally for generations.** Hyland was told by a village elder**, “If we could read what is in here, we would know for the first time who we truly are.”**

The strings are khipus, devices invented by indigenous Andeans to store information. Khipus are mostly known by archaeologists as the records of the Inka civilization, the vast multiethnic empire that encompassed as many as 18 million people and nearly 3,000 miles along the Andes and the Pacific coast of South America. Builders of the spectacular mountain fortress of Machu Picchu, the Inka ruled from the early 1400s until the Spanish conquest began in 1532.

According to Spanish chroniclers, the Inka did not write; instead, **they tied information into khipus, which documented all matters of affairs: tributes, censuses, calendars, laws, rituals and narrative histories.** But no Spaniards bothered to chronicle how information was encoded into strings, and so the records of the Inka lay unread, tied up in some 950 surviving khipus, scattered around the world in museums and other collections.

This could change, thanks to insights gleaned from the **Collata khipus and several others recently discovered in villages and through archaeological excavations.**

“I very much believe that within my lifetime, we’ll be able to interpret khipus,” says Hyland, who is based at the University of St. Andrews in Scotland. “I don’t think it’s going to be easy.”

**More Than Memory Aids**

The traditional khipu system was fairly standard. There is a primary top cord, to which pendant cords are tied. The pendant cords may be tied with subsidiary cords, which may be tied with more subsidiary cords, and so on. The most elaborate khipus, which could be census records of annual tributes owed to Inka lords, contain upward of 1,500 pendants dangling from the primary cord and six levels of subsidiaries branching from the pendants. Other khipus are just a few strings, made by herders to keep stock of grazing animals.

**More than a century ago, Leslie Leland Locke, a historian of mathematics, determined how knots on the cords represent numbers in a base-10 decimal system**. For example, the number 385 would be coded by 3 linked knots, followed by a space, then 8 linked knots, a space, and then a special long knot, used only for numbers 2 through 9, with 5 turns to express the number 5.

This is the one aspect of the khipu code that has been deciphered — and many scholars believe it is the only aspect to decipher. The traditional view among archaeologists is that khipus kept numerical data and were memory aids, like rosary beads. Anyone could read the numbers, but *what* a khipu counted would be known only by its maker.

**But there are clues that khipus contain much more information**. Some don’t have knots, and some have cords that vary by fiber type and color. Moreover, **Spanish colonial documents indicate that khipus recorded laws, rituals and history.** And discovering such greater complexity hidden in the khipus would help answer a long-simmering question: How could the Inka manage a vast, bureaucratic empire without a proper writing system?

**Ancient Binary Code**

**Gary Urton, considered the foremost authority on khipus, is convinced the cords were more than memory aids.** The Harvard anthropologist, who has studied the strings for 25 years, introduces himself as “one of the two or three people in the world who actually spend their entire time fretting about the khipus. . . these devices that look like knotted mops.”

He has shaggy, gray bangs, rectangular glasses and the demeanor of a hippie absorbed in serious philosophical pondering. Urton admits that his obsession with khipus may stem from his severe childhood stutter, which made him feel like thoughts were trapped inside him, just as Inka records are trapped in their cords. That, and the fact that he quit Cub Scouts because he couldn’t master knot tying.

According to Urton, **khipus were a standardized way of recording specific ideas in permanent signs: in other words, a writing system.**

He has methodically analyzed about 650 khipus, documenting every cord and knot, as well as more **subtle details such as patterns of spacing and color, ply (the direction a cord twists) and knot orientation (S-knots cross the string left to right; Z-knots cross right to left).**

“Either the whole damn thing is just a riot of idiosyncratic knotting and tying and colors, or there’s some order to it,” he says.

In 2003, **Urton proposed a model for this order, arguing that khipus recorded information using an ancient binary code. Just as computers can encode anything through sequences of 0s and 1s, the khipu symbolized ideas through features of the strings that are inherently binary, such as the S or Z knots, clockwise or counterclockwise ply, and fibers of cotton or animal fiber.** At the time, Urton identified **seven binary features**, which would allow for **128 distinct signs. Including different colors would make over 1,000 signs**. He did not think the system was alphabetic, with signs representing sounds**. Rather, he saw it as semasiographic: Signs had meanings, similar to musical notes and mathematical symbols.**

The theory was certainly provocative, and contested. “Any individual element he identifies could be significant in a khipu, or it might not be,” says Galen Brokaw, a scholar of the Latin American and Latino Studies department at Montana State University. Brokaw has written the comprehensive book *A History of the Khipu*based on archaeological evidence and colonial-era manuscripts that mention the devices. Although individual texts can be misleading, by considering all the sources together, you can get closer to the real story, he says.

And there was no direct evidence in these sources or elsewhere to support Urton’s binary code idea — at least not back when he first proposed it.

**Khipus in the Mountains**

**Urton’s model comes from patterns observed in the khipus, influenced by ethnographic research. He’s spent years living in Andean villages, learning how the people view the world, how they classify things and organize society.** His unique insights, says Hyland, are the result of “his very deep knowledge and understanding of Andean culture and just having looked at so many khipus for so long.”

Still, she would read his ideas and think, **“Yeah, maybe he’s right, maybe he’s wrong, who knows.” There was no way to check the claims.** As far as any scholars knew, the last people to read khipus were ancient history.

Then in the mid-’90s, Frank Salomon, an anthropologist at the University of Wisconsin-Madison, discovered khipus in Peru’s rural Huarochirí province, about 60 miles from bustling Lima but over 10,000 feet higher in the mountains and a world away in terms of lifestyle. **In addition to using alphabetic writing, people in Huarochirí were recording information with Inka-style khipus into the 20th century.** The last khipu experts died a couple of generations ago, but villagers today recall aspects of how the devices worked.

Salomon says he was “**floored because at that time, khipus were known primarily as archaeological objects and not anything that is part of our modernity.”**

Since then, he and Hyland have found more khipus in other Andean villages. **Unlike the ancient specimens in museums, these are associated with living memories and written documents, which provide clues to deciphering them.**

And the cords appear to support Urton’s theory. “I’m studying these khipus, and I don’t know how many times I said to myself, ‘Oh shit, Gary was right,’ ” says Hyland.

**For example, Urton knew that Andean people classify things into pairs of higher and lower value, such as milking cows versus dry cows, or labor done by men versus women. (Sorry, fellow women; in some villages, our work is worth only half that of men.) Observing patterns of knot direction on ancient khipus, he hypothesized that S- and Z-knots indicated the higher- and lower-ranked components of a pair.**

**Hyland found this to be true for a khipu board, a device used by post-colonial Andeans familiar with both letters and strings. Khipu boards listed names in alphabetic script; each written name was accompanied by a cord representing that person’s fulfillment of community and religious obligations, such as attending a ritual or participating in the annual village-wide task of cleaning an irrigation canal.**

Hyland studied a board that dates back to the 1800s. Although many names were faded by bat urine and dirt, she was able to read most through a camera that combines visible, ultraviolet and infrared light, revealing trace pigments that can’t be seen by the human eye. Then, working with the four oldest community members, she assigned the names to social groups. Among the identifiable names, those with S-knots belonged to one social group, those with Z-knots to another.

In another case, Hyland found archival notes from an interview in 1935 between an archaeologist and a local khipu expert. She was able to compare this testimony with the actual khipus discussed, now in a Lima museum, and to further question the expert’s grandson, who still resides in Huarochirí.

**The results confirmed that individual data, such as the goods or services of a single person, were represented by color banding along the primary cord: a series of pendants in one color, followed by a series of pendants of another color**. Aggregated data — for example, a summary accounting for a whole village — were denoted by a primary cord with a different color pattern: a single pendant of one color, followed by a single pendant of another color, and so on.

**Phonetic Potential**

However, **Hyland’s most recent research into the Collata khipus suggests the cords may do something that Urton did not anticipate: They may symbolize sounds.**

**The two Collata khipus have strings of 14 colors, made from six different animals, including alpaca, llama and vizcacha, a rabbit-like rodent. Combinations of color, fiber and ply create 95 distinct symbols. That number is within the range of logosyllabic writing systems, which use signs to represent both sounds and full words, such as Japanese kanji.**

Hyland believes, based on discussions with community members as well as colonial manuscripts in the same box**, that these khipus were messages between Collata and the nearby village of Casta about their revolt against the Spanish in the late 1700s.** **Andeans likely used khipus at that time to ensure that Spanish authorities could not intercept their communications.**

**As messages, these khipus probably end with the names of the senders. According to the villagers, one of the khipus was created by the Alluka lineage. Relating the sounds in this name to variables in the final strings, Hyland proposed a phonetic decipherment of it. For instance, she hypothesized that the final “ka” sound is represented by a blue S-ply cord of llama wool. The correlation makes sense because ankas was the regional dialect word for blue.**

Astonishingly, when she applied this phonetic code to the final strings of the second khipu, they read Yakapar — the name of one of the only two family lineages in Casta.

“If they’re phonetic, that raises a whole new realm of possibility,” says Hyland.

**Digging Up Context**

It’s unclear how far back Hyland’s findings can be pushed. Phonetic signs in the Collata khipus may have ancient roots — or they could be a modern innovation by post-colonial Andeans who, aware of alphabetic scripts, added phonetic signs to the traditional cord system.

The same is true for anything discerned from recent khipus**. Like all writing systems, the khipu code would not have been static; it would have evolved across time, space and function. A khipu chronicling imperial history, for example, may have used different conventions than one counting a herder’s llamas.** Shakespeare wrote differently than bards in the Twitterverse.

**“Even if you figure out what one khipu means, that is going to tell you what that khipu means in that context,” cautions Brokaw. It won’t necessarily give you the key to reading all strings.**

**To understand Inka khipus, researchers need khipus from Inka contexts, associated with clues to indicate how they were used. Most ancient khipus were obtained by looters and sold to collectors without details concerning where they were from or what else was with them. Those recovered by archaeologists have primarily been from burials, not in their normal places of daily use.**

This changed in 2013, when Peruvian archaeologist Alejandro Chu started uncovering dozens of khipus at the site of Inkawasi, an Inka military post, storage facility and administrative center on the southern coast of Peru. The most extraordinary part: **Some khipus were discovered with particular food items. One was buried with black beans, two were in a basket with chili peppers, and 14 khipus were covered with peanuts. It is the first time khipus have been found in the context where they were used.**

**The First Inka History**

As excavations at Inkawasi continue, the associations between strings and things add a missing dimension to our understanding of khipus: how the Inka used them before the Spanish arrived. By combining this archaeological evidence with the colonial written sources, more recent khipus and indigenous knowledge, researchers are learning more about — and from — the cords than ever before.

In his newest book, **Inka History in Knots, published in April, Urton** interprets khipus to describe a two-year calendar of labor assignments, a census reporting the social status of groups in a village, and bean counting (literally) at Inkawasi. The information is as lively as tax returns, but it is the first Inka history from Inka records.

“All our understanding of the Inkas and their empire is filtered through the minds of 16th-century Spaniards,” says Urton. “My intention is to work with the khipus and let the Inka speak for themselves.”

**Editor's Note:** What happened to the Inca Empire? Most scholars now prefer Inka, a spelling that better reflects its roots in the indigenous Quechua language.