

# Numerical recording systems among the indigenous groups of southern Costa Rica

Keilyn Rodríguez-Sánchez<sup>1\*</sup>, Scott Palumbo<sup>2</sup> & Frank Morales-Céspedes<sup>3</sup>

<sup>1</sup> Universidad de Costa Rica, Anthropology School, San José, Costa Rica

<sup>2</sup> College of Lake County, Anthropology Department, Illinois, United States

<sup>3</sup> Boruca indigenous leader, Boruca, Puntarenas, Costa Rica

\*Contact author: [keilyn.rodriguez@ucr.ac.cr](mailto:keilyn.rodriguez@ucr.ac.cr)

**Abstract:** The main objective of this document is to present indigenous notational systems, and their recent forms of usage, in three Chibchan towns in Costa Rica, an area where there were no empires or states during the pre-Columbian period, to associate the use of this recording technology with these types of political systems, as it has been done until recently. This is a qualitative and exploratory study. In Talamancas, there are records from 1875 to the present. Among Borucas, Ngöbes and Bribris, this practice had mainly a mnemonic use. Thanks to these results, we are left to analyze and rethink the association of this record form with the presence of states or empires in the archaeological past, and the possibility of creating recoding systems.

**Keywords:** knotted cord; indigenous writing; Central America; *kipu*; ethnomathematics.

## Los sistemas de registro numérico entre los grupos indígenas del sur de Costa Rica

**Resumen:** Este documento tiene como objetivo central exponer los sistemas de notación de los indígenas, así como sus formas de uso reciente en tres pueblos chibchenses de Costa Rica, área donde no existió imperios o estados en la época precolombina como para asociar el uso de esta técnica de registro con ese tipo de sistema político, como se ha hecho hasta el presente. Este estudio es cualitativo y de carácter exploratorio. Se encuentra registros desde 1875 en Talamancas hasta el presente. Entre los borucas, los ngöbes y los bribris esta práctica tuvo principalmente un uso mnemotécnico. Gracias a estos resultados, queda por analizar y replantear la asociación de esta forma de registro con la presencia de estados o imperios en el pasado arqueológico y con la posibilidad de la creación de sistemas de recodificación.

**Palabras clave:** cordón con nudos; escritura indígena; Centroamérica; *kipu*; etnomatemáticas.

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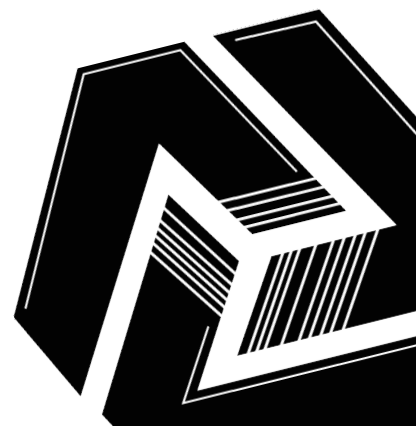
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## Introduction<sup>1</sup>

This article reports the existence of recording systems in the form of knotted cords and their different uses in three Chibchan indigenous communities in Costa Rica: Borucas, Ngöbes and Bribris. (Figure 1). Although the field work included the Cabécares and the Malekus, the oral tradition of these two peoples does not recall the presence of this system. The two oldest references we have found are: in the case of the indigenous people of Talamanca, Gabb's record (1875; see photograph of the object in Figure 2); and in the case of the Cabécares, there is also a reference to the use of knotted cords at the end of the last century (Pittier, 1897). Both dates quite close to each other.

In this paper, we present a general background on knotted cords or *kipus* of South America; likewise, we describe the field work procedure that we followed among the indigenous peoples of Costa Rica to account for the knotted cord recording systems. Finally, we present a general discussion on our findings and a conclusion.

## Background of knotted cords

The indigenous peoples of ancient America had different recording systems; the best known of these include: codices, calendars, pictograms and *kipus* or knotted cords.

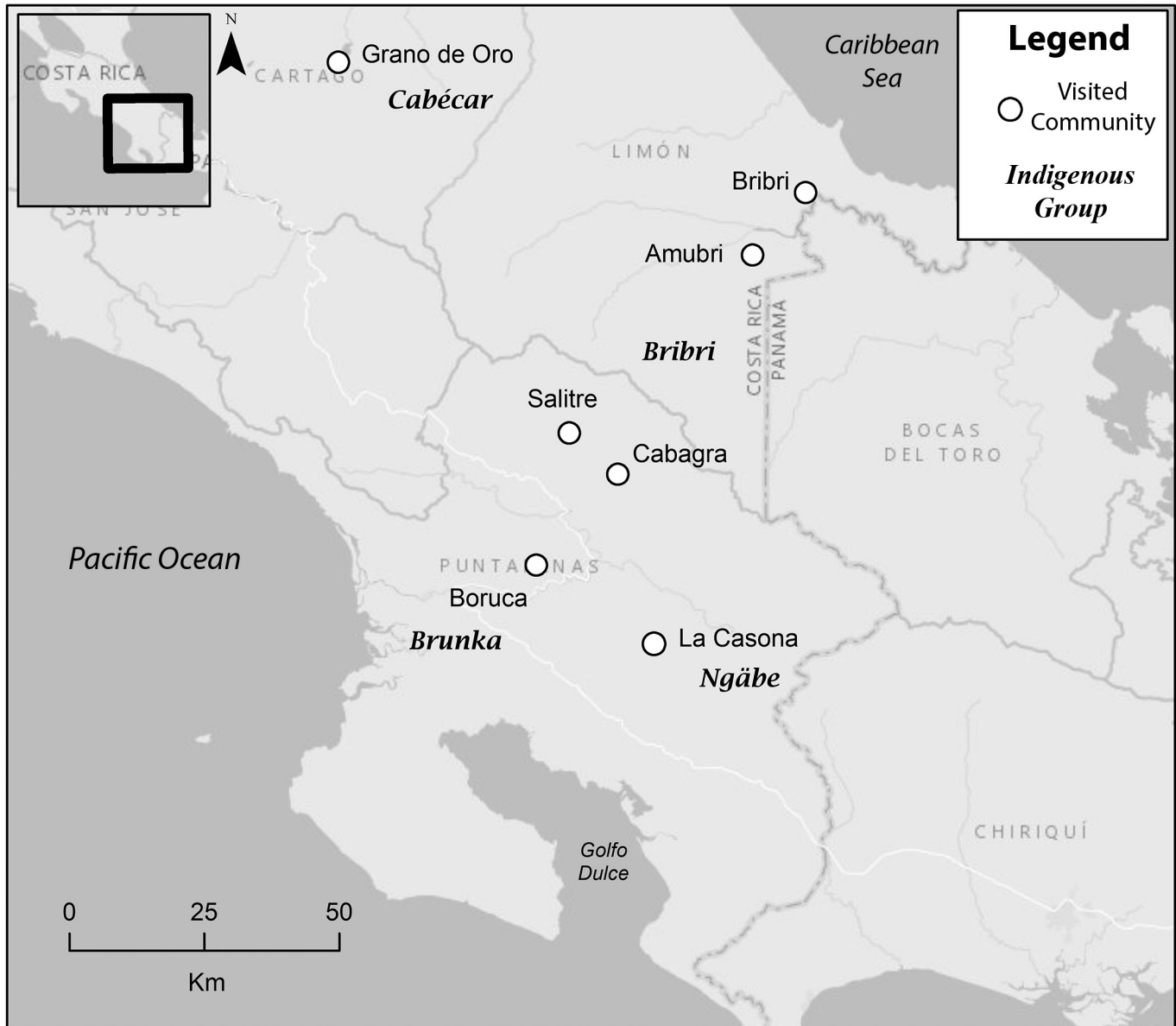
All of these have been classified, some as mnemonic notation systems and others have been linked to semasiography. There is great controversy about assigning these terms to the different types of recorded *kipus*. Recent discussions refer to an explanation of a more hybrid use that includes mnemonics in a more domestic sphere, places and people; and the semasiography in community, state and standardized environment (Arellano-Huffmann, 2011).

In this sense, the development of writing has been considered the greatest of the evolutionary thresholds of human societies. In the past, history was divided from prehistory, separating literate societies from preliterate ones. The latter has shaped the study population of archeology. Both Childe (1950) and Kroeber (1947) felt and believed that the presence of writing was one of the chief ways to define civilization, being a criterion used by archaeologists today to define states and empires.

Goody and Watt (1963) went a step further by arguing that writing preserves insights of history, and that it is essential to the development of the types of syllogistic reasoning underlying predictive sciences. These studies are based on a very traditional glottographic concept of writing that was common in Europe and Asia, which means that it was defined as a series of symbols reflecting elements of speech.

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**Figure 1:** Location of indigenous groups of southern Costa Rica (Cabécar, Bribri, Brunka and Ngäbe) and their main communities. Scott Palumbo, November 2019.



**Figure 2:** Model kept by Gabb from the Talamanca census. Photograph by Scott Palumbo, April 2018.

Inscriptive media, whose conventions are poorly understood and probably non-glottographic, raise questions about what constitutes writing versus other forms of signed systems (Boone, 2004), and this is part of the interests of comparative anthropologists. It is understood that inscriptive media have fulfilled one of the main functions in writing: transmission of information in its original form through larger geographical distances and generations in time. This type of means was associated with the presence of the indigenous state and empire throughout the American continent and was rarely linked to a glottographic writing, as it has been done in other places of the world.

The development of inscriptive media, such as the act of making permanent notations by means of a signed system, has been considered to have been encouraged especially by the political demands of states and empires. This can best be illustrated by the Central Andean knotted cord devices known as *khipu*.

*Khipu* is a word in the Quechua language to refer to a "knot". It is an example of a three-dimensional and portable inscriptive media used by the Incas and other societies of the Central Andes. It was made of cotton threads or camelid fibers. The typical appearance of an Inca *khipu*, as shown in various museum exhibits, includes a large number of cords hanging in vertical positions, with different types of knots tied to a main cord in a horizontal position (usually without knots).

One *khipu* model shown by Locke (1923) and originally identified as reflecting a base-ten (or decimal) numerical system, was hanging cords, stained in several colors and with clusters of knots separated from other clusters of knots. Most research on *khipu* focuses on the semiotic capacity and conventional uses of these devices. Both historical and archaeological samples (well preserved in desert sites on the Peruvian coast) illustrate that these devices record accounting information such as storage inventories (Urton and Chu, 2015), population censuses, and tax obligations of corporate groups ( Medrano & Urton, 2018).

The *kipu* was not only an Inca invention, but it also has a background throughout the Wari empire (Urton, 2014) and maybe in Caral as well (Shady, Narváes & López, 2000). Andean models suggest the association between inscriptive media and political complexity.

The most recent studies on the history of the popular *kipu* have been on the Andes. They show how the *kipu* continued to be produced during the colonial period to supply the Spanish viceroyalty with a wide variety of information (Hyland, 2014, 2016; Salomon, 2004a), which continues to maintain a connection to a complex political economy. There are more than a dozen examples of anthropological research studies on the *kipu* documenting both past and current uses (Salomon, 2004b).

In the case of the Andean *kipus*, Brokaw (2011) points out that during the colonial period recording systems with three uses were found: the historiographical *kipu* narrates events that happened and are relevant to the people; the administrative or statistical *kipu* that incorporates the use of censuses, tax records, and demographic records associated with calendars; and the ecclesiastical *kipu* that incorporated calendars of religious festivals, prayers, confessions, and the like.

Arellano-Huffmann (2009a) points out that among Mapuches this device was used in war as summons letters among disputing caciques; to remember messages taken from one place to another without losing tone, words and any other important aspects for the cacique; for calendrical use; administrative use and as a distinction of social group by color; and for household use in the field of a family economy.

Likewise, there are references to the use of this type of notation system among the Huichols of Mexico (Medina-Miranda, 2012) in the mid-19th century as a way of registering inventories and ritual pilgrimages. The author also refers to the use of knotted cords in the Gran Nayar since 1822.

In this sense, and contrary to the association of the state or empire with the use of *kipu* or similar inscriptive means, research by Mackey (1970, 1990a, 1990b, 2002) states that ranch managers and camelid herders used their own knotted cord records without being linked to the presence of the state. Examples from the 20th century do not display the characteristic Inca structure, but they were manufactured in a variety of ways. However, it remains uncertain whether these modern examples were derived from the *kipu* forged by earlier states and empires (for example Uhle [1897]), or whether they rather reflect a tradition of inscriptive media separate or independent from the claims of the states.

To address the questions raised in the previous paragraph, it is necessary to look beyond those areas of the world where indigenous states and empires originally developed. Costa Rica and its borders are one of these areas. The indigenous societies of ancient Costa Rica and the surrounding Isthmus-Colombian area were located thousands of kilometers away from the nearest pre-Columbian state or empire (Sheets, 1992). An unfortunate fact is that archaeologists were often tempted to deal only with impressive states and empires; as a result of this the area in question received comparatively little scholarly attention for many decades.

In Costa Rica, Gabb's *kipu* (Smithsonian Catalog # E15438-0) is known as associated with southern Costa Rica, specifically the provinces of Limón and Puntarenas, lands of the Bribri and Cabécar peoples. That *kipu* is a 19th century device of knotted cords created by various "(...) intelligent and well-informed..." Bribri men (Gabb, 1875, p. 492) to record a census of five valleys in Alta Talamanca, located in the Atlantic basin. This device is one of the only two specimens known from the Isthmo-Colombian Area,

and it is preserved at the Smithsonian Institution Museum Support Center in the United States. The other is a single knotted cord made by an Emberá in the Pacific-Colombian area (Wassén, 1935); it is kept in the Swedish National Museum of Culture (accession number 1935.14.0226).

Thus, we have records that the Cabécares and Bribris used knotted cords before 1875, when Gabb requested the aforementioned census, and up to the present in a Bribri case, but most ceased to use these notation systems in the early 1970s.

Among the Ngöbes of western Panama in the 1970s, ethnographer Phillip Young reports that messengers carried a "(...) knotted cord (ki igwa) to mark the days remaining " (1976, p. 42) for a ceremonial gathering (a *krun* or *balsería*); these data are also referred to by Montezuma-Montezuma (2018).

We know twenty historical references to the *kipu* in the Isthmo-Colombian Area (some have been cited above) from the past two centuries. They indicate that the practice extends from the Honduran Caribbean to central Colombia, suggesting a widespread use of this form of inscriptive media in Central America and Colombia; and also an equivalent number of references from northern Amazonia. For the purposes of comparative anthropology, it is important to note that these examples challenge the idea that such knotted cord signed systems developed and spread to serve the goals of expanding states or empires because these areas lacked them. Therefore, we are interested in knowing who used those media and for what purposes.

In the case of Costa Rica, in addition to the written references by Gabb and Pittier, there is a brief report by Vásquez-Hernández (2014) that indicates the existence of the *kipu* in Costa Rica. However, there is no detailed information; it only reports that this type of record existed among the Bribris.

## Procedure of the field work

We carried out a qualitative-exploratory study (Vasilachis de Gialdino, 2006) through conversational interviews (Valles, 1999) to find out if the knotted cord existed, the forms they remember, its different uses, who used it (differentiation by sex, status or age) and associated crafting materials and details.

Between July 2018 and January 2020 we carried out several field trips to the following communities:

1. Grano de Oro, to find Cabécar informants, one field trip. No information was recorded on the use of the knotted cord from sixteen elderly informants from different communities of Chirripó Arriba.

2. Guatuzo, one field trip to Maleku. Group interview with nine artisans. No information on the use of the knotted cord from the Maleku people was recorded.

3. Boruca, four field trips. It is important to note that one of the authors of this document is a Boruca; so he himself collected the information on the subject among the elders, who are also his relatives and friends, through conversations with them. In addition, we interviewed other elderly adults of such community. We conducted a total of five interviews.

4. La Casona to interview the Ngöbes, two field trips. We conducted three interviews.

5. The Bribris, a field trip to Cashabri, Salitre, Amubre, Cababra and Bribri (Talamanca). To obtain information about the Bribris, we interviewed Alí García Segura, who works for Universidad de Costa Rica

and has several publications on indigenous issues. In addition, we asked Dr. María Eugenia Bozzoli for information, and she kindly shared her field notes on the subject of the Bribris. We conducted nine interviews in all.

In all cases we look for elderly adults to interview them. Once we were with the informants, we asked them to receive us to talk about what they remembered about knotted fabric threads or cords. Then, we read the informed consent to them; and upon getting their approval, we began by showing them a photograph of the knotted cord reported by Gabb (1875). We asked if they had seen anything similar in their communities or in the homes of their parents or grandparents. We recorded the conversations when people allowed us to. We transcribed the most significant interviews for data systematization through a classic content analysis.

In Table 1 we provide a synthesis of the information from the research subjects who collaborated and are cited in this article. As can be seen, we conducted 17 interviews, all of which were recorded and transcribed. Although we consulted more people in each community, we only interviewed those who remembered more or novel information.

**Table 1:** Informants.

Informant's Code	Ethnic Group	Observations
BI1	Boruca	Frank Morales Céspedes. Retired teacher. Elderly male. Co-author of this paper
BI2	Boruca	Adult female who lived with her husband's grandmother. Highly influential women in the community
BI3	Boruca	Elderly female, one of the important leaders of the community
BI4	Boruca	Elderly male, seaman of the community
BI5	Boruca	Elderly female, one of the important leaders of the community
NI1	Ngöbe	Elderly male, husband of the Cacique's sister
NI2	Ngöbe	Elderly female, a Caciques' sister
NI3	Ngöbe	Elderly female, grandmother of one of the culture teachers
BB1	Bribri	Alí García Segura. Technical worker of Universidad de Costa Rica. Raised in Talamanca. Author of several publications on the Bribri people
BA2	Bribri	Terencio Porras, elderly male, <i>awá</i> * of Amubre
BC3	Bribri	Hernán García, elderly male of Cashabri
BC4	Bribri	Ricardo Morales López, elderly male of Cashabri, <i>awá</i>
BC5		Rosa Sánchez, wife of Ricardo Morales, Cashabr elderly
BB6	Bribri	Timoteo Jackson, elderly male of Bribri
BCb7	Bribri	Isidro Torres Torres, elderly male of Cabagra
BS8	Bribri	Zacarias Elizondo Figueroa, elderly male of Salitre
BC9	Bribri	Fausto Morales López, elderly male of Cashabri

\**Awá* is a traditional doctor who integrates a spiritual view into his practice; so he is an intermediary between humans and the spiritual world.

## Research results

The results of the field work we carried out show that the use of knotted cords is present until the early 1970s in three indigenous groups; the Borucas, the Ngöbes and the Bribris, as detailed below:

### Knotted cords among the Borucas

The Borucas are located in two neighboring towns in southern Costa Rica (see map in Figure 1). They are engaged in agriculture and handicrafts. Currently, they are Spanish-speaking, so we did not find a term associated to the knotted cord.

In order to identify whether the Boruca indigenous people used knotted cords to keep accounts or classifications in a way similar or different from the well-known *kipus* of the Incas, we talked with 19 elderly adults and 3 adults from the community. In all, only five people remember that their ancestors or they used the system of knotted cords.

Another elderly female (BI3, interview, July 2018 and born in 1950), who is one of the oldest leaders in the community, remembers that when she was 10 years old, in 1960, the sacristan would make them tie knots to keep track of the 33 creeds for the Good Friday prayers of the Holy Week. Said sacristan was the son of an indigenous family, and his father was also a sacristan in town. Another 80-year-old elderly female (BI5, interview July 2018) corroborated this use of knotted cords to pray during the Holy Week.

We identified an adult female (BI2, interview, July, 2018) who remembers that her late mother-in-law (1918-1998), who was the wife of one of the most important and remembered leaders of the community, used knots made with fabric "(...) not to forget important things", and she remembers that she used colored fabric strips to which she tied knots "(...) to remember important dates and birthdays". She tells that she had them hanging on a wall. No other informant remembers this type of use.

She pointed out that "(...) she kept track of her domestic animals..." and of "household goods" (BI2, interview, July 2018). Also, "(...) if a grandson was given a cow or..." or something else, she kept track of it with that system; for example, plates, spoons, glasses and pots with different knots and with different colored fabrics. That was two generations before her. Likewise, her late father-in-law (1912-2003) used to sell rice and beans and kept account of the sacks of grains with knots on a cord.

The knotted cord recording system is recalled by an elderly male (BI1: interview, July and October 2018), who reports that, before the 1970s, ownership was collective and they worked through *juntas* (groups of people who came together especially to harvest or do some other jobs together; in exchange for that, whoever invited to the meeting had to provide dance, food, *chicha* and shelter). So, the harvest was kept in the *tabanco* (ceiling) of a special *lorón* (house used for storing food) that was located a few meters from the main house. This information was confirmed by another elderly adult (BI4: interview of July



2018), who says that his grandfather kept track of the harvest and the sale of grains through a measure unit they called "*churuco*". Informants do not remember the weight of a *churuco*, but they say that it was made with a tree bark that was given a cylindrical shape and joined with a board, the base was made with the same bark. It was about a meter high.

At that time, some people had cattle and each animal had its name and recognized its owner. For this reason, when animal owners blew shells, the cattle would approach them. So "(...) they kept a monthly account of the cattle..." (BI1, interview, July 2018), especially of the oxen, which were highly valued; oxen, cows, bulls or calves were recorded with different knots or with a certain number of knots. Animals were recorded when they were born and as they grew in their life cycle (calf-steer-cow or bull), changes were marked in the month of the year they occurred. The account was kept on a board to which twelve holes were made with a nail, and then, 12 threads were hung from there; one for each month of the year; and this way, month by month, they kept an account of the animals they had, the animals that there were, that were born or died was kept (omitting a knot in the month of death or adding a knot to signal when the animal was born).

What is interesting about this system is that in January, once the account of stock is completed, February is recorded right there and so the other months up to December. In the place of the cord for the month of February, the months of February to December are recorded. Then, in the place of the month of March, the months of March to December are recorded, and so on.

Knots were attached to the central thread of the respective month, in this way different colors, number of knots (for example, two knots could refer to a particular animal, three knots to another) and types of knots could be used to identify sex, name and development over time of each animal.

As stated above, on the one hand, when an animal dies, it is no longer represented in the signed system and thus the month of its death is recorded. Now, this informant reminds us that on several occasions: "I told you at the beginning, do you remember? that there were different types of systems..." (Informant 1, July, 2018) referring to the way of recording each animal. So, a person can improvise creatively on a personal record system. It is important to point out what the informant (I1, July 2018) tells: "You have to learn which knot is for each thing in order to do it quickly." In other words, complete information is not found on the record system to read the record properly; one must know what each knot represents. The creator of the record defines a signified and a signifier and memorizes them to allow record continuity throughout the year.

On the other hand, in addition to the use of knots in a cord, seeds and some type of cane were used; these were introduced into a cord for the same purpose, as above stated.

Figure 3 shows an example of another type of record, using seeds instead of knots, and some type of cane. This records the calves of a cow in one year; it can be noted that one calf is lost in November and another in December, ending the year with only one. In this case, the loss of young animals can occur, for example, because they were given to somebody else, exchanged for something or, simply because they died.



**Figure 3:** System recording a cow and its calves in one year. Photograph: Scott Palumbo, July 2018. Boruca.

A simpler record is for salt-fed cattle, as follows:

Informant 1: Murice, so they painted it here, and that also meant that this cord was for salt-fed cattle, it was salty.

Keilyn: What is it? Ah, that the cattle ate salt!

Informant 1: Yes, they ate salt, that is, they were already ready for the salt, they had it all right.

Keilyn: Aaaah, but how do they keep track of the salt meals if that's every day?

Informant 1: Oh yes, but no, the same family was not fed every day (B11, interview, July 2018).

The complexity of the system is that since each animal had its own representation form associated with its own name, then the respective knot was made when it was fed salt. This account would not make sense if it were fed by type of animal (cows, bullocks, calves and the like).

Animals were identified by name, not color, and they were associated to a type of knot, or to a certain number of knots regarding a particular animal.

There is a shared logic in the way of assembling the knots with threads. However, the association of the form of recording a specific animal was done by memorizing the specific code. Table 2 summarizes the use of this recording means and the material with which it is made.

### Knotted cords among the Ngöbes

The Ngöbes residing in La Casona, near San Vito de Coto Brus, in southern Costa Rica (see map in Figure 1) are engaged in agriculture and handicrafts. Informants (elderly adults) are mainly monolingual, but they do not remember a term in their vernacular language associated with the recording system object of this study.

We found that the registration system with knots has been used. The memories of informants NI1, NI2 and NI3 (interviews, July 2018) concur. They point out that their parents used to send invitations for parties, balserías or celebrations to their relatives or people who lived far away with someone using a cabuya thread with a certain number of knots.

For this purpose, the host had to calculate the number of days it took the messenger to reach the guest's house and the days remaining for the activity. Thus, counting and cutting began the day after the messenger delivered the knotted thread or cord to the guest. The guest had to cut one knot each day. On the day of the event, the guest showed up with the cord and the host had to cut the last knot on the spot. This is one of two semasiographic use cases we recorded.

Another way of counting days was used when someone left home. If the person went out for fifteen days, fifteen knots were tied and one was cut each day, until the fifteenth day was over, the day when the person was expected to return.

It seems that in La Casona, this practice was present until the 1960s approximately. Today, it is not used. Despite the above, a female Informant (NI2, July, 2018) made for us a model of the one used by her father. See Figure 4 below.

Finally, we refer a story entitled "The great *sukia* Jiron Day." This story tells about a dispute between the Ngöbe and the Miskito. The former consult with their *sukia* Jiron Day to guide them in their defense against the Miskitos. The *sukia* is the indigenous specialist doctor and provides various advices, one of them refers to:

**Table 2:** Use of the knotted cord and related materials, among the Borucas.

Use	Reference	Material
Important dates and birthdays	“(…) to remember important dates and birthdays” (BI2, entrevista, julio, 2018)	Colored fabric threads and knots
Account for harvests, household goods and animals	“(…) she kept track of her domestic animals …” and household goods (BI2, interview, July 2018)	
Record of legacies	“…if a grandchild was given a cow or …” something else, she kept track of this. (BI2)	Knotted cord, natural fibers
Account for sales	Her late father in law (1912-2003) sold rice and beans, and kept the record of the sacks of grains by using a knotted cord (BI2, interview, July de 2018)	
Account for catholic prayers	The sacristan asked them to make knots to keep track of the 33 creeds for the Good Friday prayers during Holy Week (BI3, interview, July de 2018)	
Record of the number of births, growth and deaths, or beef cattle sales	“(…) they kept monthly records of the cattle …” (BI1, interview, July 2018)	Threads attached to a board with added knots, threads with seeds beads and some type of yarn
Keep track of fed animals	“Informant 1: Murice, so they painted it here and that also meant that with this cord the cattle was already salt-fed, it was salty” (BI1, interview, July 2018)	

Then the great *sukia* [specialist dictator] told them:

-Now take this knotted thread and invite the Miskito cacique and his people to come play balsa with us at the end of the last knot of the thread (Montezuma-Montezuma, 2018, p. 37).

In this way, the use of the knotted cord is confirmed as a traditional practice.

### Knotted cords among the Bribri

We found references to the use of knots in different Bribri indigenous communities, among Talamanca Bribri (Bribri, Cashabri and Amubre communities), Cabagra and Salitre (see map in Figure 1). All groups these are located in southern Costa Rica and are engaged in agriculture and tourism. Interviewees requested us to use their names, and thus, they are added to the references, unlike the other sections. Most of the elderly people we talked to are monolingual in Bribri language.

Alí García Segura (BB1, interview, October 30, 2018) tells us that the term knotted cord in his language is *tsa'wö*. He grew up on the region of Cuén and Coroma.



**Figure 4:** Ngöbe model of knotted cabuya to count days. Photograph: Keilyn Rodríguez-Sánchez, July 2018.

According to García, the best-known *tsa'wö* was used to control time length, especially when the Bribris traveled from Talamanca to the Pacific coast to make the ball of salt<sup>2</sup>. Days were calculated from the departure of travelers until they returned. In this way, those who stayed at home could keep track of the travelers' return, and prepare the reception ceremony at the precise time of the arrival of the travelers. He notes that it is not correct to say that they used it for trade or for products.

García points out that there were at least three models of use of the knotted cord, which were all for counting: "(...) the one for counting days, the one for counting the beginning of life into the world of light

<sup>2</sup>The ball of salt or stone was obtained from seawater by evaporation, and they made it in a ball shape. The reception ceremony is typical of those towns where all the work they did was accompanied by a ceremony of reciprocity with the spiritual beings who owned the resources and who provided them with something (M. E. Bozzoli, personal communication, November 2018).

and the one for counting the life of someone leaving to the world of light. The latter two do not record<sup>3</sup> it as a counting method. According to Bribri knowledge, it was” (BB1 Alí García, interview, November 1, 2018).

In turn, Dr. Bozzoli, who has worked in Salitre, states that:

(...) to remember, the elderly hung a knotted cord. For example, if someone went to Limón (or San José) and was going to return in 15 days, they would tie a little knot in the cord each day, and calculated how many days until return (I am not so sure if they tied 15 knots and they untied one every day), and I think I remember that they were used for other things depending on the number of little knots they made. I asked them the name of the little knotted cord and they told me it was *jtsáwö*, in Salitre, where cord is called *jtsa'* and *wö* refers to the rounded shape of the knot. The interesting thing is that *jtsáwö* is the name of the letters as well. That is why a school is called *jtsáwöwe*, where we means ‘house of’ (school = house of letters) (personal communication, June 8, 2018).

Regarding this aspect of keeping account of days with knots, Don Tenencio Porrás de Amubre also comments that his grandmother taught him about knots because his uncle was in jail, so she kept track of the time he spent in jail. He tells that: “(...) that's what she did. So she started... today he went to jail so she tied a knot; he has one day; another knot tomorrow, until... until the whole month” (BA2, interview, July 2019).

Also in Cashabri, Don Ricardo Morales (BC4, interview, July 2019) tells us about the same use of the knotted cord to keep track of the days in prison of an arrested person.

Don Tenencio remembers another use of the knotted cord in relation to women's fertility; he says the following about menstruation:

Terencio: Of course a woman does this; she has one of those cords, and then, the first day she has her period, she ties a knot...

Keilyn: Umm

Terencio: The next day another knot...

Keilyn: Another? It's not that she cuts them, but she rather ties them.

Terencio: No, no. She only ties and leaves it, just like that. So when it finishes you realize how many days...

That way she keeps track of her menstrual cycle (when she can get pregnant and when her period will return). In addition, the woman keeps track of the days of her pregnancy, Don Tenencio asserts that: “(...) that (menstruation) will come back again, and on which day... how many days it will last and on which day

<sup>3</sup> It refers to the registration of Gabb's data sheet located on the *Museum Support Center* of the *Smithsonian Institution*.

she will get pregnant. When she is already pregnant, they already know how to tie the first knot in the little thread [cord] that is, for pregnancy... "(BA2, interview, July, 2019).

Another important aspect noted by this informant is that they used color to distinguish what is counted: "(...) well, explain this color more or less, if this color is green, it represents one thing" (BA2, interview, July of 2019).

Despite indicating the use of color, another informant points out that cords were not dyed: "There are no colors, only knots" (BC5, interview, July 2019).

This same use is mentioned in Cashabri. Doña Rosa Sánchez states that:

(...) if the count (of the pregnancy) is kept... the nine months... The count begins with the absence of pregnancy... ...they realize (when the baby will be born) by the nine knots of the moon. Women should clearly know how many months of pregnancy they have. Knowing that there is a month left, when they are eight, they must go talk to the *awá* so that they can accommodate the baby and perform ceremonies... to have healthy babies and to avoid diseases for babies and mothers (BC5, interview, July, 2019 ).

This aspect is very important because this is the only use that is presently recorded; women who currently keep track of their menstrual cycle: "(...) then my sisters too, she also grew up along with my sisters... since they were women, she ... she teaches her things more broadly... so, she certainly learned it there, and does all that (short silence)" (Interview with Mr. Tenencio, July 2019).

That could be a second semasiographic use, since this form of recording was taught by older women, according to the informant.

Now, Don Isidro Torres (BCb7, interview, July 2019) from Salitre comments that in the past, when a child was born, a knot was tied every day. Thus, when the time came to baptize him and register him with the priest, they would take the knotted cord so that the priest would know the day the baby was born.

Regarding fertility, we find another use of *tsa'wö*, linked to the land and the knowledge on its relationship with the moon for the process of cropping and appropriation of natural resources in general. Don Fausto Morales López comments that the *tsa'wö* was used as a planting almanac or calendar that kept an account of the changes of the moon and what they call the four seasons or times.

When talking about the moon, it is important to keep track with the *tsa'wö*, since it allows you to locate the tasks associated with the important tasks of harvesting, cultivating, and building houses. Don Fausto explains to us what is shown in Table 3.

It is important to note that keeping track of the phases of the moon is not enough; Don Fausto says that you have to locate the season or the time in which they occur, in order to take advantage of the correct moment for each stage of the crops. According to him, the four seasons or times are: the rainy season, slashing and burning, planting and pruning, and harvesting. All those are recorded with knots; one knot per day, so

**Table 3:** Moon phases and associated tasks.

Moon	Time	Task
Full	After the full moon phase and before the new moon phase	Planting everything that produces fruit, i.e. avocado and peji-baye. Plants grow rather low, easiness for collection if they are planted during this time
New	During new moon phase	Peeling tree bark, making firewood or house posts. Wood will be free from pests if cut at this time
	After the new moon phase	Leaf cutting for house construction
Waning	After the full moon phase	Sowing banana and plantain

you know when it is going to rain, when you have to prune and so on. This might give the idea of a notation system with recoding, but it is not because it continues to be a system counting of days and and it is based on the type of moon observed at that time.

Finally, the use that we describe below is greatly important for different historical disciplines because we found that knotted cords were used by caciques to keep track of social offenses (theft, incest, murder, and others) committed by a clan<sup>4</sup>, not by a person. For Bribris and the Cabécares, those clans that fail to meet cultural rules repeatedly tend to disappear, and they may emerge again later.

In this context, it could hypothetically be considered that clans with the greatest number of offences (according to the number of knots) were eventually punished by the cacique, limiting their possibilities of economic-social relationship with the rest of the community. Moreover, no one would want to marry them. These aspects resulted in their exclusion and reduction, as a way of social control.

The way in which one clan distinguishes from another regarding the recording system is through figures that they set on top of the agave cord. Figures were related to the name of the clan; if it is a type of bird, that is represented; if it is something abstract, then a design is made with something representing it. The cacique hung them on a horizontal post of the house, where he was adding knots according to the case and keeping track of the offences of each clan. Don Ricardo Morales of Cashabri (BC4), commented with regard to the only *awá*:

(...) the time will come, over time, it is discovered and it is noticed, all those clans in place, it is recorded which are the clans that behave well, and which are the ones that are no so good, the bad ones... Clans that do not they obey, or that misbehave ... who are the ones committing incest because those marry *dutwak* with *dutwak*.  
 (...) so it is right there where education, teaching and everything ... is ordered. (Interview, July 2019).

<sup>4</sup>The Bribris and the Cabécares are organized in matrilineal clans or families.



**Table 4:** Use of the *tsa'wö* and materials used among Bribris.

Function	Use	Reference	Material
Fertility control	Human fertility: Record of the menstrual and pregnancy cycle	“(…) when the period comes and when it comes again… (when they are pregnant), women record, they must be very clear about the number of months …” (BC5, interview, July 2019)	
	Soil fertility in relation to the moon: slash-and-burn, sowing, pruning, harvest and collection	“(…) children have been always taught with the little knot to keep records … They also keep account of the 4 seasons with knots… (…) here are 8 knots because if they cut during the new moon, there is a moth bug that sucks and ruins it, and everything breaks, it does not last for one year or months” (BC9, interview, July 2019)	Pita in natural color or dyed in different colors with natural dyes
Social and political control	Cacique’s socio-political control	“(…) the cacique like the juru Antonio, let’s say the king, keeps account…” (BC4 interview, July 2019)	
	Record of a person in jail	“Then she began … today he went to jail, then she tied a knot … (…) until de complete the month … (…) BA2, interview, July 2019)	A reference is made to using some sort of vine, but they do not remember its name
	Record of the days of a traveler	“(…) then, in eight days … eight of those little knots … and that is done by the person who is coming or they are waiting for another person … He gets home and ties it in the hammock side rail.” (BS8, interview, July 2019)	
Records of the days after birth or after death			

In summary, the use of the *tsa'wö* among Bribris has been as an ethnomathematical mechanism, to keep accounts and record quantitative descriptive data on different aspects of daily, social, reproductive, economic and sociopolitical life (Table 4). They were hung from horizontal posts of the house or from the hammock, and they were made with perishable materials. Certainly, it is in Talamanca where we can find much more information and memories about the *tsa'wö*.

**Table 5:** Type of record with knots in three indigenous communities of Costa Rica.

Purpose of use	Community			
	Type of Record	Boruca	Ngöbe	Bribri ( <i>tsa'wö</i> )
Fertility Control	Record of quantities of harvests, animals or objects	x	-	-
	Record of types of objects or animals and growth control and new broods over time	x	-	-
	Fertility of women and crops	-	-	x
Counts of objects, animals, agricultural products and days	Record of types of objects, animals and quantities	x	-	-
	Record of time in days for travelers	x	x	x*
	Record of time in days for people in jail	-	-	x
	Record of births and deaths	-	-	x
Socio-political control	Socio-political	-	-	x
	Sending of interethnic invitations	-	x	-
Totals		4	2	5

\* Cabécares also used this system (Pittier, 1897).

## Discussion

We can assert that the use of knotted or beaded cords to record and control information has been used, mostly until the early 1970s, in three of the four indigenous groups that were consulted: the Borucas, the Ngöbes and the Bribris. Although the Cashabri Bribris mention that the Cabécares also used it, we did not find any further oral evidence or details in this regard. However, Pittier (1897) states that the knotted cord among the Cabécares had a use similar to that of the Borucas, Ngöbes and Bribris; to keep account of the days a person took to arrive at a place. That is the only confirmed accurate specific for the case of interethnic communication.

Borucas and Bribris report greater diversity in the forms of registration than Ngöbes and also greater diversity in the type of recording. Table 5 summarizes the type of record found according to the ethnic group consulted.

As can be seen in Table 5, Borucas and Bribris are the indigenous peoples who report the greatest diversity in the types of the knotted cord record. They used the information recording system for quantities, fertility control and socio-political control. However, the most complex system we found is that of the Borucas because, in addition to keeping records, it also categorizes (cows, bulls, calves, steers) and keeps track of the development of the animals over the year.

It is important to point out that it seems that, among the Borucas, this traditional system, which has been sustained over time, actually depends upon the non-indigenous system of counting the months of the year; and it keeps record of non-Amerindian animals, such as European cattle. At the same time, it keeps the account of animals and products that are indeed Amerindian. Following an autochthonous strategy, it keeps the account of a Catholic prayer.

The Borucas keep their tradition innovated by incorporating non-traditional cultural information, as it has already been reported for this ethnic group in other cases, such maintaining the tradition of making masks where traditional design and symbolism coexist with novel designs for the market; and consequently as a central economic activity of the community (Campos-Chavarría, 2018).

The use of knotted cords for all groups occurred in the context of the household economy, and to count, it was used by both men and women; and it was made of perishable materials. On the one hand, we did not find any differences by gender in the use of the knotted cord between the Borucas and the Ngöbes. On the other hand, among the Bribris we verified some differences by gender and status, since it was the cacique who used the knotted cord to control the behavior of clans; but at the same time, it was used by the common people.

Thus, the Bribris used the knotted cord for household use to record the biography of people (we do not know if of all people or only of specific characters); the Ngöbes used it to record the return of a relative when they were traveling and in the social sphere (to invite to a party); and the Bribris used it in the economic-religious context and sociopolitical control.

Moreover, the Borucas and the Bribris used knotted cords to remember specific days; such the birth or death of someone. In this sense, it would be interesting to review funerary excavation contexts to study whether what has been called necklaces are really an account of the time of the deceased's life.

In the same way, both the Bribris and the Ngöbes used this type of record as a social communication system, to be understood by others, which suggests a more semasiographic use. The Borucas, however, have a diversity of uses in the personal sphere and upon household matters, where the general mechanism of recording with knots is shared, but only its creator knows how to associate the knots with the things that he is interested to record. The creator must memorize what each knot, seed, or sequence of knots represents in order to read the device.

With regard to the materials used to make these objects, we have a record of natural fibers or cords, fabric strips that could be dyed with natural dyes. To represent different categories, a variety of knot types, figures made with fibers on top, and sequences of knots followed by gaps without knots were used. For example, a big knot can represent a cow, followed by two small knots representing its calves, but two big knots in a row can represent a bull. Between the first and the second representation there is a space that is greater than between the cow and its calves; or, seeds and some kind of rope. When the system was more complex, a support was used to hang the cords. All these materials are characterized by being perishable in the short term.

The date when this practice was lost is quite similar between the Borucas and the Ngöbes. Based on testimonies, it is estimated that it was during the 1960s and before the 1970s. However, in the case of the Bribris, it is still used, but possibly by very few families. We located the current use of this system in only one family.

The three communities where the practice of using knotted cords was recorded are located in the central-eastern region of the country towards the south. The following would be necessary to research:

1. How was the interethnic communication mediated through this inscriptive media? Would it have been limited to sending invitations?

2. Did this practice exist among the peoples in the northern region of the country? How far did the practice spread?

3. Additionally, evidence was offered of the use of a inscriptive media in non-state societies or that were not geographically located near states that existed before the Spanish conquest. Therefore, it is necessary to consider that there is not necessarily a link between the state and the inscriptive media.

4. Based on the various uses recorded for this notation system, it would be necessary to consider in future investigations if they allow inferring the creation of recording systems.

5. A deeper historical review is necessary to help us identify other references to this type of record and its possible uses and functions in the pre-Columbian past.

Likewise, we find many of the uses of *kipus* reported as recent in South America to be related to those described in this study. Table 6 presents a detail of this.

It is important to point out that the structure of this recording device is not considered in this study, although they are very similar (cord and knots); and possibly materials and the reading logic vary. The comparison presented is only about usage in very general terms. For example, in the category of reproduction control, Pimentel (2009) reports that the Aymará incorporate the use of the *kipu* with a magical perspective on animals, while we found that, among the Bribri, a record is used to know about reproduction times of animals, people and crops.

However, we cannot establish a direct and empirical connection of the relationship of the existing recording systems between the Incas and the original peoples studied, but we can establish the beginning of new ways to understand the communication systems of the indigenous worlds of the studied region.

**Table 6:** Similar uses of recording systems among indigenous groups of Costa Rica and some peoples of South America.

Similar uses	Places or peoples in Costa Rica	Places or peoples in South America
Counting days	Bribri, Cabécar (Pittier, 1897), Ngöbe	Cuzco and Chuquibamba (Zudeima, 2009)
Agriculture related information	Bribri	Aymará (Pimentel, 2009)
Household use	Boruca, Ngöbe	Azángaro (Salomón, 2004b)
Population censuses	Talamanca (Gabb, 1875)	Perú (Medrano y Urton, 2018)
Reproduction control	Bribri	Condor Pampa, Aymará (Pimentel, 2009)
Ecclesiastical use	Boruca	Los Andes (Brokaw, 2011)
Cattle or grazing Record	Boruca	El Cuzco (Mackey, 2002)
Political administrative use	Bribri	Mapuche (Arellano-Huffmann, 2009a), Los Andes (Brokaw, 2011)
Invitations to other persons or peoples	Ngöbe	Mapuches (Arellano-Huffmann, 2009a)

## Conclusion

The study of South American *kipus* has had a very strong interdisciplinary component. Over history, archaeology and cultural anthropology have attempted to explain its use and function.

Our study reports the recent use of this recording system, since we do not have archaeological evidence at the moment. This limitation makes it difficult to establish any reliable relationships with the *kipu*.

Analyses of knotted cord data in southern Costa Rica indicate that their use was primarily related to mnemonic elements. Knotted cords in southern Costa Rica generally neither have a standardized use, nor were they handled exclusively by specialists, the forms of use varied greatly and were adapted to meet individual needs, household use and, in a few cases, community and administrative needs.

On the one hand, we identified an indication of use of a semasiographic nature among the Ngöbes and among the Bribris in invitations decorated with knotted cords. On the other hand, the most complex type is located among the Borucas, and it is for administrative use, although it is not clear if it had a standardized use in the past (although it is always used at the village level) among the indigenous cattle farmers and the sacristans who administered the cattle of the Catholic Church. All these concerns remain for future research.

We concluded that the different families and indigenous groups did not follow the same format, but they used this recording means in a creative and improvisational way in the household sphere. The work we present on these records shows a world view obtained from previously unsystematized primary sources, and it evidences how indigenous peoples classified their worlds into categories that they considered significant. Perhaps in the past, the semasiographic use of this recording system had a stronger presence in the life of indigenous peoples.

A final note of this paper is that southern Costa Rica represents an area of the world where inscriptive media were used for reasons unrelated to contact with a state. A traditional and unfortunate mistake is that this region has been marginalized in research, being considered uninteresting for lacking indigenous states or empires. However, paradoxically, this situation reveals that people preferred to create recording media in the absence of highly developed social hierarchies or bureaucracies.

Indigenous peoples used knotted cords, especially in their daily household life and made with perishable materials, to keep track of time, to send invitations with precise dates to neighbors, and to maintain numerical inventories, among others. This situation encourages us to approach societies of tropical forests from a different perspective, as in this case, which would allow us to identify innovations in the forms of communication through knotted cords, as we are now learning to recognize and appreciate.

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