

# Hacking Sound, Hacking History: Patricia Cadavid and the Electronic\_Khipu\_

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Figure 1: Still from 2019 Performance of the Electronic\_Khipu\_, "Knotting the memory//Encoding the Khipu\_", Linz [5]

## Abstract

To better understand researcher and artist Patricia Cadavid Hinojosa's instrument the Electronic\_Khipu\_, we must define the project as an instance of hacking. Cadavid deconstructs colonial understandings of the Andean device known as the khipu, pulling apart the academic view of khipus as artifacts to be deciphered, the strict delineation between administrative and ritualistic uses of the khipu, and the separation of the oral tradition from the object. Through deliberate design choices and musical expression in performance, Cadavid emphasizes the inextricability of coding, art, and ritual by creating a tactile device that re-tells history and challenges the false oppositional binary between Indigeneity and technology. Understanding this project of digital lutherie as an act of creation through hacking – specifically as the deconstruction and reconfiguration of artistic and historical components, utilizing scholars Astrida Neimani's and Vít Bohal's definitions – allows us to appreciate its power.

## Keywords

Hacking, NIME, Khipu, Tangible Interface

## 1 Introduction

On October 8th 2019, Laddy Patricia Cadavid Hinojosa performed her instrument the Electronic\_Khipu\_ for the first time at the Ars Electronica Center in Linz, Austria [5]. The artist projected real-time video of her hands on a large screen: she twisted, knotted, manipulated the strings, then paused and let the sounds play out. The instrument is named for the khipu,<sup>1</sup> a device used by the Inka empire and earlier Andean societies (the earliest khipu has been dated to between 779 and 981 C.E.) [21]. Used for administrative and memory-keeping purposes, khipus transmitted information through knotted cords. Cadavid's khipu consists of a main cord with eight conductive subsidiary cords made of rubber; sensitive to the performer's touch, each cord produces a stable sonic value while untied. A different stable value is created when a string is under tension, and a fluctuating value results from a string being knotted. The instrument is capable of producing both gradual and sudden shifts– as Cadavid wrapped the last string around itself in the 2019 performance, spitting, seething noises combined with the sound of a rainstick transition into an overpowering sound

<sup>1</sup>In this paper I use the current Andean spellings, "Khipu" and "Inka," although older works and citations will appear as they were originally published ("Quipu" and "Inca").



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of recorded wind glitching in and out. As she knotted and pulled another string taut, a tumbling, discordant and unpredictable pattern entered the soundscape. Her knots made active meaning; her twists and the sound they produced arrived together. We, the audience, witnessed a moment of creation as hacking.

Hacking is a potent term; we use it colloquially and academically to give the sense of something anti-institutional, something illicit, something that uses materials or tools against their original purpose to further a hacker's goals. With the rise of hacktivism—hacking for a politically motivated reason—the concept of hacking has the connotation of turning an oppressive technology into a liberating one. Interpreting Cadavid's work as hacking is key to understanding that Cadavid is acting on something through creation, not just acting nor just creating. By manipulating and subverting our conceptions of Indigeneity and technology, she hacks general understandings of khipus, establishes a new artistic medium, and destabilizes the enduring colonial status quo.

## 2 Definition(s) of Hacking

We can understand what is at stake in Cadavid's hacking if we first turn to the ways that scholars have used the term. Definitions of hacking abound in scholarly discussions on topics such as cyber security, bio- and gender-hacking, and hacktivism. In this paper, I build off of a narrow set of poetic and precise definitions that emerge from feminist and xenofeminist, queer, and anticolonial theory in order to articulate exactly how Cadavid is hacking.

Following a series of live discussions on the concept of the anthropocene in Sydney from 2016–2018, scholars collected an archive titled *Feminist, Queer, Anticolonial Propositions for Hacking the Anthropocene*. In its introduction, Astrida Neimanis offers four definitions of hacking.

Hacking (1) / to deploy unauthorized actants to interrupt, to intervene, to use the system against itself. To torque the method in order to produce results that serve different bodies, and different purposes. To put a spanner in the works. As in: hacking the mainframe, hacking into the database. As in: I've been hacked!

Hacking (2) / to withstand, to bear, to carry the burden. As in: can you hack it? Or: I just can't hack it. As in: try to hack it just a little longer.

Hacking (3) / to cut into, to chop, perhaps recklessly, or determinedly. To channel anger and rage. Potentially violent and destructive. Potentially cathartic. In reference to one's work or project: to radically subtract, clarify, and determine what is excessive or optional, and what, conversely, cannot be done without.

Hacking (4) / to cough wretchedly. To attempt to rid oneself of disturbing bits of matter. As in: I feel like I'm hacking up a lung. As in: a hacking cough, which may be a persistent endeavor without the satisfaction of immediate relief [18].

In line with the “repurposing” definition of hacking, Vít Bohal writes in “Hacking the Syntagm: Xenofeminism Against Paranoid Praxis” that Xenofeminism has a “hacker ethic” because it

“sets out to connect, disconnect, buffer, network, scrap, etc. various composites of code and language, and form novel couplings which would retain the plasticity of power” [4]. He quotes Canadian Art's interview with Lucca Fraser, a scholar and member of the collective that wrote the Xenofeminism Manifesto:

When asked whether ‘the master's tools [could] ever dismantle the master's house,’ Lucca Fraser answers ‘Yes. Both literally and figuratively yes. That's what tools are—they've got uses that go beyond their masters' intentions. And they've got weaknesses that can be exploited to make them do things they weren't intended to do. Which is basically what hacking means. This doesn't mean we shouldn't invent new tools. The more the better. But yes, absolutely, the master's tools can dismantle the master's house. How could they not?’ [9]

In “Hacking Xena: Technological Innovation and Queer Influence in the Production of Mainstream Television,” Elena Maris discusses fandom interaction with the television show *Xena*: “I call these queer advances ‘hacks’ because of their core similarities in intent and disruption of normative systems of power through playful technological tactics deployed in spaces opened up by the industry's weaknesses in the face of innovation” [16]. These definitions of hacking, especially their emphasis on taking place within a system while disrupting it, open up space for contextualizing, analyzing, and interpreting Cadavid's work.

## 3 Understandings of the Khipu

First, we must understand what system Cadavid is working in; namely, the academic, non-academic, and artistic intellectual understanding of khipus. Khipus generally consist of a horizontal main cord with subsidiary cords tied perpendicularly to it; the subsidiary cords communicate information by the placement and direction of knots, their color, and their type of fiber. Khipumayuqs (khipu knotters and readers) recorded many different types of information in khipus: censuses, calendars and cosmologies, inventories, tribute records, royal chronicles, sacred places/beings and sacrifices, royal successions and genealogies, routes and way stations, and accounts of herds [19]. Under Spanish colonial rule in the Andes, Spanish priests and officials initially tolerated and even respected khipus, often eliciting information from khipumayuqs for their own colonial records; however, by the end of the sixteenth century khipus were deemed idolatrous and ordered to be burned [22]. This did not eliminate them completely. Jesuits later allowed Indigenous Andeans to bring khipus to confession, the knotted cords were used through the 19th and 20th century, often to record the resources of an hacienda or in personal inheritance records, and some Andean villages retain stories of the khipus and store large knotted cords in local archives. Even so, a vast number of khipus have been lost, along with knowledge of the range and history of khipu-making practices [15].

Scholars (archaeologists, anthropologists, historians, and others) have generally treated khipus as codes to be cracked, a puzzle treasured as “one of the world's last undeciphered historical mediums” [14]. One way they have attempted to decipher the hidden messages is to digitize khipus into public databases, the most prominent being The Harvard Khipu Database and the Khipu Field Guide database. Researchers register khipus in

spreadsheets by measuring the length of the primary cord, types of twists, and many other details and then compare khipus with Spanish colonial documents. This allows researchers to analyze patterns and try to decode what each individual element signifies. Scholars have delineated the khipus into two categories: administrative and non-administrative khipus. Administrative khipus form eighty-five percent of remaining khipus and are much more extensively studied [8].

#### 4 The Electronic\_Khipu\_ as Hacking

Cadavid draws from the feminist sociologist and historian Silvia Riviera Cusicanqui, who argues that the “Western reading and vision of khipus, obsessed with establishing their numerical and mathematical logics, have however turned them into codes without a message” [6]. Artists such as Cecilia Vicuña and Jorge Eduardo Eielson have also pushed back against the academic treatment of khipus as codes to be deciphered or knots turned into isolated data cells. In Vicuña’s most recent exhibit at the Guggenheim Museum in New York City, “Cecilia Vicuña: Spin Spin Triangulene,” she created khipus by draping wool, natural plant fibers, and horsehair from the ceiling, interweaving the fibers with metal, wood, seashells, nutshells, seeds, bone, clay, plaster, and plastic in the place of knots, as well as scribbling sentence fragments in a corner of a vast wall. Instead of allowing her khipus to be decoded, she emphasizes an illegibility akin to poetry. Viewers are encouraged to make their own connections between the objects and words Vicuña presents [24].

Cadavid, while honoring the artistic and theoretical lineage of Cusicanqui and Vicuña in deemphasizing decoding the khipu, redefines and subverts the encoded status of the device by emphasizing its oral, tactile, and reiterative aspects instead of its illegibility. The Electronic\_Khipu\_ consists of conductive rubber cords, attached to a box, that send signals as impulses and frequency changes as MIDI data [12]. In addition to potentiometers to modulate volume and buttons to activate or deactivate the signals of each string, the performer wears a ring or bracelet that allows her to close a circuit by touching the string with her fingers [12]. The Electronic\_Khipu\_ prioritizes direct physical interaction and immediacy, which directly connects to its non-electronic counterpart, as Marcia and Robert Ascher write:

The overall aesthetic of the quipu is related to the tactile: the manner of recording and the recording itself are decidedly rhythmic; the first in the activity, the second in the effect. We seldom realize the potential of our sense of touch, and we are usually unaware of its association with rhythm. Yet anyone familiar with the activity of caressing will immediately see the connection between touch and rhythm [3]

Regina Harrison continues: “Similarly, in the act of reading a khipu, a tactile sense is primary, whether in the simple full display where the khipu ends are held, or in wrapping it around the body in ritual, or in the actual fingering of the knots and objects held in the cords,” noting as well the potentially soothing effects of fingering khipus that have recorded a set of sins when Indigenous people were forced to confess in the seventeenth century [10]. This focus on the tactile is intentionally featured by Cadavid, whose khipu strands are sensitive to a performer’s skin conductivity, touch, and force. The integration of a video feed

focused on the movements of Cadavid’s hands into each performance of the Electronic\_Khipu\_ means that the audience can see and understand the consequence of each touch and movement that Cadavid makes [11].

Building on the tactile expression of the Electronic\_Khipu\_, Cadavid pushes us to rethink the strict division of computing and ritual. The digitally technological aspects of the Electronic\_Khipu\_ (the use of touch sensors, MIDI protocol, and Digital Audio Workstations) present a complication for the perception of the work’s radicality. For audiences prone to the dangerous glorification of the technologically novel, the overtly technical components of the Electronic\_Khipu\_ could be seen as legitimizing both the less overtly technical components and the khipu itself. But Cadavid does not hack by combining “soft skills” and “hard skills,” nor by bringing a mystical, artistic device into a more advanced future: two loaded colonial concepts. The Electronic\_Khipu\_ does not push boundaries because it is similar to coding, but because it helps us understand coding as artistically expressive and ritually meaningful.

Cusicanqui wrote: “No solo eran registras numéricas sino también inscripciones propiciatorias de naturaleza ritual, que permiten ordenar el cosmos, al enumerar las ofrendas a las wak’as o lugares sagrados de culto a los antepasados” (“They [khipus] did not only record numbers but also inscriptions of a ritual nature, which permitted the ordering of the cosmos, to count the offerings to the wak’as or sacred places for worshiping ancestors”) [7]. In a recent interview, the artist and technologist Chia Amisola articulated the connection between objects for religious rituals and computers: “from pebbles, to ropes, to beads, we’ve always used technologies to aid in prayer. Maybe this tallying could be considered computation” [2]. Cusicanqui, Amisola, and Cadavid all make the argument that counting, inscription, and computation are not in opposition to creativity and the sacred, despite the administrative versus non-administrative distinction presented by anthropologists. And not only are these activities in opposition, but the tactile aspect of Cadavid’s work that urges us to understand coding as intimately connected to art and ritual – the Electronic\_Khipu\_ is a musical instrument to be manipulated by hand, which is then emphasized in its video presentation – echoing those who have fingered and counted knotted fibers before Cadavid.

Likewise, Cadavid challenges the oral/written binary that has left scholars struggling to understand the oral components of khipus and to see khipus as a form of writing. The knots in ancestral khipus “presented a series of information that needed to be completed with speech and mnemonic exercises”: khipus were made to be read aloud [20]. Cadavid’s khipu also transmits information through sound. Its coding, rather than being obscured into an exoticized silence, makes itself heard.

Khipus were never static objects; they were often “leído, releído, intervenido en cada ciclo anual, sus nudos desatados y vueltos a anudar o añadidos con nuevas cuerdas y ramificaciones” (“read, re-read, intervened upon in every annual cycle, its knots untied and re-tied and add to the khipu with new cords and ramifications”) [7]. In scholar Rosaleen Howard’s study of oral history and memory in Andean cultures, she has found that, in storytelling in this region, the “past is ever present and is ever being remade, in the here and now; memory is a continuous process of reactivation and reformulation of the past relative to present circumstances” [13]. The Electronic\_Khipu\_ is an instrument specifically designed to be live-coded: as Cadavid writes, “the

algorithm is knotted live” [12]. It is important to note that this improvisation requires significant practice and mastery: the cyclical and spontaneous nature of the *Electronic\_Khipu* closely mirrors cultural practices while resisting dominant understandings of musical mastery [12]. Additionally, by creating a khipu that embodies her narrative of the destruction of colonialism, Cadavid is creating an object that makes and remakes collective memory. Because so much of what is powerful in Cadavid’s work has resonances with the khipus of the past, it is easy to read the *Electronic\_Khipu* as a continuation or riff off of a template, a personal modification of ancestral technologies. But Cadavid’s work pushes beyond this; she unmakes and then makes the khipu, “knots untied and tied” [7].

Cadavid has broken down the khipu into separate parts and then pieced together the most disruptive components (the oral, tactile, and reiterative aspects of the khipu) with other elements that add semantic power; this is the central thrust of her hacking. This unmaking and piecing together of the khipu is most apparent during her performances. Each string in her khipu is attached to a sound sample and a different sound effect (frequency, modulation rate, pitch, etc.) that allows the sound density to increase [11]. In various performances, she has chosen both ambient sounds from Ableton samplers core library, wind sounds from Ableton, and samples recorded from a rain stick to connect to the cords, in addition to accompanying sounds from a bombo leguero (an Argentinian drum), a zampoña (a wind instrument originating in Wari culture), and recordings from cacerolazo protests (protests against the government utilizing pots, pans, and other noise-making devices) in Colombia in 2019 [1]. There are many easy binary distinctions to make between Cadavid’s sample selections: generic/personal, institutional/resistant, colonial/Indigenous, technological/natural. But like in much of the continuous aspects of Cadavid’s work as discussed above, she hacks these binaries, co-opting their logics and exclusive boundaries in order to create a larger work.

This comes through in Cadavid’s performances: through her manipulation, sounds mingle and play off of each other, creating a dynamic and intricate whole in which listeners/viewers can still recognize shifting parts and individual actors. Cadavid both resists and twists the electro-acoustic tradition of *musique concrète*, in which composers seek to disconnect sounds from their source. Though the audience does not know from where the sounds derive and most sounds are manipulated, she strategically chooses which sounds to give recognizability (ambient nature sounds and the rainstick are two examples). Often she will let the audience rest upon a sound and notice its particularities, but the majority of sounds change throughout the performance. In the stark black-and-white graphical representation of the performance projected onto a screen, we see her hands knotting and re-knotting with a patterned bracelet (which forms a connection with a banana plug in the ground of the system, allowing a circuit to close when fingers touch the string) [11]. She draws attention to the supposed differences between technology and Indigeneity, between noise and music, between the generic and the personal, and then consistently blurs the lines, evolves the sounds, and lets the individual parts co-create a whole with each other. This is resonant with Vít Bohal’s definition of hacking: to “connect, disconnect, buffer, network, scrap, etc. various composites of code and language, and form novel couplings which would retain the plasticity of power” [4]. Cadavid twists together and harnesses the power structures and languages of technology

and of anticolonial sonic design to create something bigger than each part.

## 5 Conclusion

If we understand Cadavid’s work as hacking, we can see beyond the simpler narratives that her work may initially appear to represent. Discussions of Vicuña’s work offer an example of these easier narratives – Vicuña describes making khipus as “traveling through time,” while critics write that “being in the presence of Vicuña, or her art, feels like opening a portal to an unplaceable time—somewhere distant and fabled” and that “Vicuña channels this ancient, sensorial mode of communication” [17, 23, 23]. Cadavid’s work resists these narratives of khipus as ancient, mystical, sensorial devices that are heavily reliant on the relegation of Indigeneity as non-modern. Understanding the *Electronic\_Khipu* as hacking emphasizes that Cadavid has created a tool that purposefully twists and reimagines sets of ideas and practices that have limited what technology means, what Indigeneity means, what khipus mean while working in these frameworks.

Returning to the definitions of hacking outlined in the beginning of the paper can help identify the exact method she is using to hack. It could be argued that the *Electronic\_Khipu* hacks by using the system against itself and through both operating in and challenging the Western academic and colonial system, in line with Neimanis’ first definition of hacking (“To torque the method in order to produce results that serve different bodies, and different purposes. To put a spanner in the works” [18]). This is certainly part of what Cadavid is doing, but her work finds its power more in the combination of two other definitions: Neimanis’ third definition, “to cut into, to chop, perhaps recklessly, or determinedly. To channel anger and rage. Potentially violent and destructive. Potentially cathartic. In reference to one’s work or project: to radically subtract, clarify, and determine what is excessive or optional, and what, conversely, cannot be done without” [18] and Vít Bohal’s definition of a “hacker ethic,” to “connect, disconnect, buffer, network, scrap, etc. various composites of code and language, and form novel couplings which would retain the plasticity of power” [4]. To create the *Electronic\_Khipu*, Cadavid has deconstructed, with all the danger inherent to cutting and chopping, and constructed, selecting her elements carefully and precisely. Hacking doesn’t have to be just tweaking lines of code within an existing framework—Cadavid shows us this by creating a process, a means of threatening and acting upon colonialism through tearing-down and building-up, that presents itself as an instrument. Grappling with the *Electronic\_Khipu* as hacking can help us appreciate how much stronger and more complex Cadavid’s work is than the structures it challenges. Western academic and colonial comprehensions of khipus, as devices to be decoded or relics of a once-great civilization, are dehumanizing and represent a lack of understanding of what makes khipus so powerful. Cadavid harnesses aspects of khipus, technology, and music that are not literally nor metaphorically legible under the enduring effects of colonialism, untying and then tying again.

## 6 Ethical Standards

This project was made possible by the STRIDE research program at Smith College. It consisted entirely of theoretical work and analysis of online performances with no interviews, so no official ethical approval process was pursued. All attempts were made to portray the artist carefully and thoughtfully.

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