

“Listen to the Cuia”: An Amazonian Case of Integrating Ancestral Knowledge and Biodesign Towards a Multispecies Approach

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ABSTRACT

This study investigates how ancestral knowledge can enrich biodesign through the case of Cuia Colab, a project based in the Brazilian Amazon rainforest. Integrating design with traditional craftsmanship, the project works with cuias — vessels made from the fruit of *Crescentia cujete* — and focuses on a central question: How long does it take for a cuia to ripen? The research utilizes a mixed-method approach, combining literature review with participatory observation conducted with traditional cuia artisans. Fieldwork revealed a mode of production rooted in embodied perception, ecological attentiveness, and shared responsibility — standing in contrast to industrial logics of optimization and replicability. The artisans’ expertise shifted the project’s focus from temporal metrics to sensory and relational approaches, highlighting the value of “listening to the cuia.” The study concludes by moving toward a multispecies design perspective, proposing a biodesign practice that embraces care, perception, and relationality.

Keywords: Amazon Forest, Ancestral Knowledge, Biodesign, Cuias.

INTRODUCTION

In the field of design, a significant consequence of the ongoing planetary crisis is the effort to engage with nature and to conceive of human beings as integral components of the broader environment, rather than as its dominant force. An approach that emerges from this perspective is the concept of “more-than-human” or “multispecies” design, which involves “designing for the interdependent relationships between humans, technologies, and other organisms” (Rosén et al., 2024). This approach is particularly relevant in the context of biodesign, a discipline in which designers collaborate with living organisms. In seeking to engage with other forms of life, designers begin to develop innovative methods to understand and learn from these organisms.

In this pursuit, Indigenous ontologies and practices offer valuable insights, as they conceive humans and “nature” as an inseparable whole (Escobar, 2018) and promote a more relational form of interaction with the environment than Western or modern frameworks generally allow. This study aims to investigate how ancestral knowledge can serve as a means to enhance biodesigners’ capacity to work with living organisms.

1. CASE STUDY CONTEXT

In 2021, the design project Cuia Colab was introduced within the context of bioeconomy startups operating in Pará, northern Brazil, in the Amazon rainforest region. The project

focused on a culturally significant native item: the cuias. These are traditional handcrafted objects made from the fruits of the tree *Crescentia cujete*, commonly used as bowls and containers (Figure 1). The main objective of Cuia Colab was to develop compostable alternatives to everyday household items, integrating biodesign principles into the production process, offering an ecological solution while preserving and promoting the cultural heritage of the cuias.



Figure1. Handcrafted cuias (left) and the tree *Crescentia cujete* (right). Source: Andrea Bandoni (2024).

The project proposed attaching molds to the fruits while they were still growing on the tree, thereby altering the shape of the cuias. This technique was inspired by historical research, which revealed an example of a molded cuia from the eighteenth century. Although this technique is unknown among contemporary cuia artisans, it resembles the work of certain biodesigners who have successfully shaped gourds: molds change the forms of fruits in a growth process that occurs naturally and without causing environmental harm, allowing nature to follow its course (Figure 2).

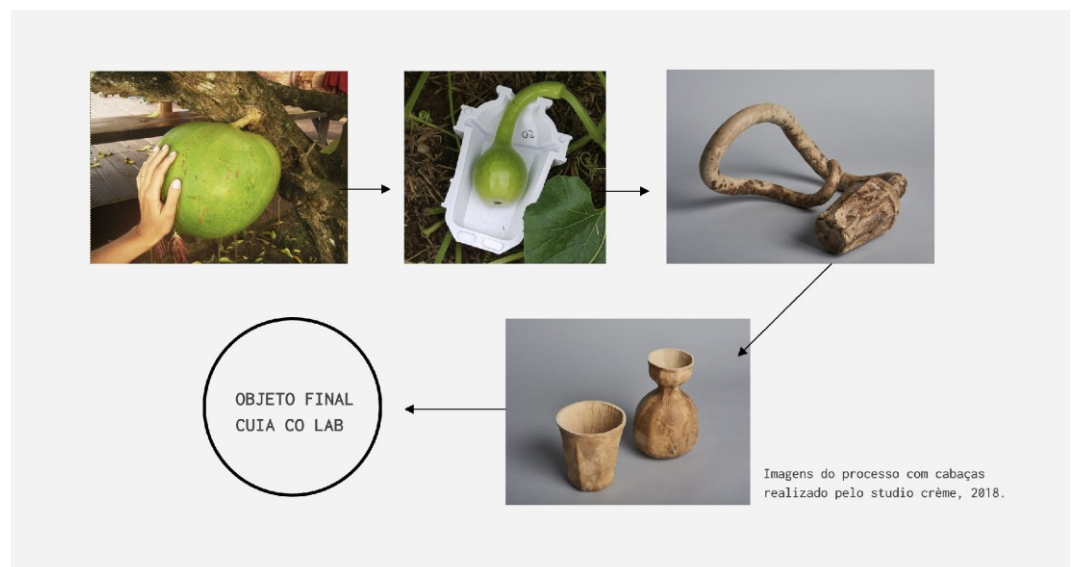


Figure 2. Cuia Colab's initial proposal, showing the process of creating an object with a molded cuia, inspired by examples of molded gourds by Studio Crème, 2018 (cremedesign.com). Source: Andrea Bandoni (2021).

For practical reasons, Cuia Colab's initial experiments took place on the campus of Universidade Federal do Pará, in Belém, in the eastern Amazon. Although the local collaborators Lauro Cohen, Marcela Cotta and Alanna Vinhas were quite familiar with cuias as regional objects present in their daily lives, and designer Andrea Bandoni had previous experience in research and projects involving cuias, none of the group members had worked directly with the tree *Crescentia cujete* or any other arboreal species prior to Cuia Colab.

The first experiments with cuia molding, conducted in August 2022, demonstrated that they could be transformed through molds, significantly altering their shape (Bandoni et al., 2024). However, a few days after harvesting a molded cuia, it shriveled and did not solidify into a durable object (Figure 3), revealing that although they can be reshaped quickly, they require a certain period to mature. This occurrence raised a fundamental question for the Cuia Colab project: how long does it take for cuias to mature and be ready for harvesting?



Figure 3. Cuia being molded on the tree (left) and the shriveled cuia after harvesting (right). Source: Marcela Cotta (2022).

To address this urgent question, which was crucial within the business framework through which the project was made viable—and which constitutes the starting point of the present study—we reviewed the relevant scientific and historical literature and conducted participant observation with traditional cuia artisans, as detailed in the following sections.

2. LITERATURE REVIEW

The 1786 treatise by the naturalist Alexandre Rodrigues Ferreira, *Memória Sobre as Cuias*, is the only text from the colonial era specifically dedicated to cuias and the only source that mentions their maturation time. Written in archaic Portuguese, the document explains that the cuieira tree bears fruit throughout the year and that its fruits mature in two months (Ferreira, 1933).

Ferreira also highlights the longstanding role of women as guardians of cuia craftsmanship and notes that they demonstrate expertise in techniques that, from the perspective of contemporary design, may be considered ecological. The author describes, for example, the use of a wide range of pigments made from natural materials and applied in the ornamentation of cuias, techniques that have since fallen into disuse and today can only be appreciated in books or museum objects. Despite the recognition of cuia production as Brazilian cultural heritage in 2015 and the subsequent development of new studies and surveys, contemporary reports (IPHAN, 2015) tend to reiterate Ferreira's eighteenth-century findings, without providing additional details regarding fruit maturation.

Research by the botanist Priscila Moreira on the domestication of *Crescentia cujete* in the Amazon offers further context, noting that cuieiras have coexisted with humans for more than 5,000 years. Exceptionally, this plant was domesticated not for its nutritional or medicinal value, but for its symbolic, aesthetic, and utilitarian qualities—that is, for the importance of cuias in material culture (Moreira, 2017). She also documents the great variety of fruit shapes

and sizes, which possibly influences maturation times and makes precise measurement difficult.

In addition, Moreira refers to a variety of medicinal uses for the “tree of care,” observing that “the cuieira is part of human healing strategies and health promotion” (2020, p. 159). She highlights its symbolic associations in Indigenous cultures, such as the use of cuias in fertility rituals and the custom of hammering a nail into the tree to promote pregnancy. These practices underscore a profound connection between cuieiras and women: they coevolve, mutually influencing one another (p. 155).

In the field of anthropology, authors such as Arturo Escobar (2018) argue that Indigenous worldviews offer important alternatives to modern paradigms by emphasizing relationality, interdependence, and the non-separation of nature and culture. This perspective resonates with the more-than-human design approach, which proposes rethinking the role of the designer as a collaborator within living systems (Rosén et al., 2024). Rather than designing *on* or *for* the world, this approach suggests designing with the world, recognizing the agency of nonhumans and the need to establish affective, ethical, and material bonds with the beings and ecosystems with which one coexists. Coops et al. (2024) complement this debate by asserting that truly sustainable design requires an ethical reconfiguration of our relationships with the material world and with nonhuman entities, rather than merely the adoption of “green” technologies.

Within the field of decolonial epistemologies, Eduardo Viveiros de Castro and Deborah Danowski (2014) emphasize the ontologically plural worlds of Amerindian cosmologies, in which the distinction between nature and culture does not apply, and relations between humans and nonhumans are mediated by animated and reciprocal perspectives. Vanessa Machado de Oliveira (2021), in turn, proposes practices of unlearning and transition in the face of the collapse of modernity, suggesting that it is necessary to “host the end of a world” in order to make space for ways of life rooted in interdependence, care, and regeneration. Both approaches reinforce the urgency of rethinking the role of design—not as a tool of technocentric innovation, but as a situated practice capable of listening to and learning from marginalized forms of knowledge, offering support for the construction of pluriversal and relationally sustainable worlds.

In the context of biodesign, authors such as Orkan Telhan (2018) and Jane Calvert (2013) problematize the boundaries between life and design, pointing to the need for critical engagement with the agency of living organisms. The articulation of these references supports the proposal of a biodesign informed by ancestral knowledge, attentive to relationality, living time, and care.

The approaches of the authors mentioned converge in their critique of the centrality of the modern human and the separation between subject and environment, proposing a design practice that recognizes the distributed and interdependent agency of all beings involved. Rather than objective and universal solutions, more-than-human design works with specific contexts, embodied practices, and ongoing relationships of care and negotiation. In contexts such as the Amazon, where traditional practices already operate according to these relational logics, this field offers not only a language, but also the possibility of political and epistemological articulation between local knowledge and emerging design practices.

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3. PARTICIPANT OBSERVATION

Participant observation is an ethnographic method that involves the researcher's immersion in the everyday life of a group or community, enabling data collection through direct coexistence, attentive listening, and participation in local practices. Unlike more distanced approaches, this method values the researcher's bodily and sensory involvement, fostering a deeper and more situated understanding of shared knowledge and practices. In the context of this study, participant observation alongside cuia artisans in Santarém, in the Amazon, provided access to tacit knowledge and ancestral techniques that would hardly have been captured through formal interviews or documentary analysis. Living and working alongside the artisans made it possible not only to observe, but to experience ways of making mediated by relationships of care, time, and perception—elements that are essential for understanding the life cycle of cuias and the ethos that sustains their traditional production.

Thus, in August 2022, shortly after the beginning of the molding experiments of the Cuia Colab project in Belém, we visited a community of traditional cuia artisans in Santarém, in the Amazon. The aim was to observe the process, learn from their expertise, and consider the potential for collaboration. Over the course of three days, artisans Silvana Maduro, Léila Maduro, and Marinalva Souza demonstrated all stages of traditional cuia production¹ (Figure 4).



Figure 4. Artisans X, Y, and Z working with cuias (left) and the stilt house where they work, on the banks of the Amazon River (right). Source: Andrea Bandoni, 2022.

Observation revealed key aspects, including the use of organic tools (Figure 5) and a circular approach that allowed non-essential parts of the cuias and organic tools to fall to the ground beneath the house, where they would decompose and nourish the garden, including the cuieira trees.



Figure 5. Organic tools used by the artisans to sand the cuias: scales of Pirarucu fish (left) and rough leaves of *Embaúba* trees (right). Source: Andrea Bandoni, 2024.

Another highlight was the collaborative nature of production: although each artisan mastered all stages, they generally specialized in tasks such as painting or decoration, ensuring that the

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final product reflected a collective effort rather than individual work, thus emphasizing the importance of community cooperation in this practice. This collaboration occurs not only among people, but also with the environment: the cuieiras grow close to the houses, receive daily care, and their unused parts return to the soil as natural fertilizer, in a cycle that sustains both the ecosystem and local culture, as observed.

According to Martins (2024), this practice is permeated by an ethic of collective care that recognizes the interdependence between humans and nonhumans, where each cuia is the result of living relationships, rather than merely of technique or material. Community collaboration, in this context, is not a productive strategy, but a way of existing and creating in consonance with the world one inhabits.

During this visit to the artisans measuring time and material quantities proved to be a difficult and imprecise task. When the artisans were asked “How long does a cuia take to mature?” the answers sounded uncertain and varied greatly, ranging from weeks to one or two months. After some time observing their way of working with cuias, the question was reformulated and asked again: “How do you know when a cuia is ready to be harvested?” From this question, one artisan replied: “You just have to listen to the cuia.”

This technique — “listening to the cuia” — involves lightly tapping the fruit while it is still attached to the tree with a knife. The sound produced indicates whether the fruit is ready to be harvested (Figure 6). As subtle differences in sound are quite difficult to discern², the artisans also explained two additional sensory methods: observing whether the cuia was turning yellow, indicating maturity, or scraping the peel with a fingernail—the peel should not come off easily when the cuia is ready to be harvested³.



Figure 6. The artisan Silvane Maduro demonstrates how to “listen to the cuia” and how to scrape the fruit’s peel to determine when cuias are ready for harvesting. Source: Andrea Bandoni, 2022.

Similarly, in Indigenous and rural practices, tapping seeds or dried fruits (such as Brazil nut pods or walnuts) helps verify whether the interior is loose and ready for consumption—a “loose” sound may indicate proper drying. Farmers and vendors use the *tapping* technique—lightly striking with their fingers—to listen to the sound of a watermelon. A hollow and deep sound usually indicates ripeness, whereas a sharp and dry sound may suggest immaturity. In tropical regions, dried coconuts are often shaken or lightly tapped to hear whether there is liquid inside. The sound of liquid moving indicates freshness; its absence may suggest aging. These practices are part of sensory and tacit knowledge transmitted orally and through practical experience, often marginalized in technical discourses. As Tim Ingold (2013) points out, craft knowledge involves a “skilled attention” to materials and to the environment, something that goes beyond mechanical measurement.

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4. RESULTS: REFRAMING TIME AND QUESTIONS

As described in previous studies (Bandoni et al., 2023), the development of Cuia Colab was deeply influenced by interactions with traditional artisans, whose ancestral knowledge provided fundamental insights, particularly in assessing fruit maturation. This expertise prompted a shift in the project's focus: from time-based approaches ("how long") to perception-based inquiries ("how do you know"). Although we were unable to reproduce the artisans' ability to "listen to the cuia," we began to recognize that fruit maturation is shaped by unique environmental and genetic factors, considering each tree and fruit as distinct cases rather than uniform commodities. Sensory knowledge thus became essential to the project, and we began to interact differently with the trees.

From the project's initial perspective, the challenge of precisely measuring time and material quantities in cuia production could hinder process improvement and replicability, especially according to conventional design parameters that value standardized metrics, variable control, and repeatability. This technical expectation, often associated with a modern and industrial rationality, stands in tension with the relational and sensory logic of Amazonian artisans. For them, the production process is shaped by continuous observation, attentive listening, and affection for living matter—an embodied knowledge constructed through coexistence with the plant, the climate, and the rhythms of place. Thus, what might be seen as an obstacle from a technical standpoint is, in fact, an expression of ecological adaptation and situated knowledge.

After a year immersed in the Amazonian startup ecosystem, Cuia Colab pursued an independent path, moving away from the acceleration-driven startup model to foreground research and ecological reflection. From that point onward, its experiments embraced variation, imperfection, and the temporal rhythms of nature, drawing inspiration from the practices of traditional artisans.

This difference reveals a fundamental contrast between the scientific-operational approach typical of design and ancestral practical wisdom—a tacit knowledge that recognizes variability as part of life rather than as an error to be corrected. Instead of seeking total control over the process, the artisans operate with unpredictability, responding to the trees' temporality and to the material's signals with sensitivity and care.

This case demonstrates how the artisans' relational understanding influenced our biodesign approach, shifting it from a human-centered perspective to one that benefits the entire ecosystem, advancing both the project and broader research goals.

5. DISCUSSION

5.1 The Dichotomy Between Ancestral and Industrial Knowledge

Designers' emphasis on time-based process solutions reflects an industrial mindset linked to modernity, which prioritizes control, standardization, and efficiency in production processes. While suitable for factory systems, this approach encounters significant challenges when applied to living systems such as trees, which do not exist within laboratory conditions and operate in complex and non-linear ways.

In contrast, Amazonian artisans employ a form of quality control that values diversity, improvisation, and responsiveness to the environment. Far from seeking uniformity or

predictability, their practices recognize that each cuia, each tree, and each harvest brings unique variations that must be welcomed rather than eliminated. This approach is rooted in ecological sensibility and in knowledge collectively constructed over generations, transmitted through everyday practice, attentive observation, and shared care. Cuia production is thus a process of listening and responding to the surroundings—to rainfall, fruit maturation, bark textures, and the sounds emitted when the cuia is tapped. More than a technical craft, it is a relationship in which humans, trees, and landscapes are in constant co-production.

This relational mode of engagement resonates with Donna Haraway's (2008) concept of "becoming with," in which different life forms mutually constitute one another through relationships of care, attention, and coevolution. The artisans' practice is a concrete example of this principle: rather than extracting ready-made objects from nature, they **grow** with the cuia, establishing a relationship of mutualism in which the fruit only becomes an object because it has been cared for, listened to, and respected in its own time. This practice also embodies a situated design and territorial awareness, where beauty resides not in standardization but in singularity and in the history inscribed in each piece. By valuing the unexpected and the unrepeatable, cuia craftsmanship directly challenges the assumptions of mass production and invites design to rethink its criteria of quality, authorship, and efficiency in light of a multispecies ethic.

Recognizing this dichotomy highlights opportunities that may emerge from integrating ancestral and industrial knowledge. Robin Wall Kimmerer (2015) deepens this perspective by advocating for synergy between traditional knowledge and Western science—not as incompatible systems, but as modes of knowing that can complement and mutually enrich one another. She describes this integration as a "dance of cross-pollination," in which ideas, practices, and ways of perceiving the world intertwine to create unprecedented possibilities for coexistence, learning, and regeneration (p. 47). For Kimmerer, this alliance must not occur asymmetrically, with science merely "validating" traditional knowledge, but rather through respectful dialogue in which both epistemological systems are recognized in their integrity, historicity, and ontological value.

In the Amazonian context of Cuia Colab, this metaphor gains particular strength: the artisans' sensory and embodied knowledge, constructed through generations of listening to and caring for the cuieira, does not oppose academic research but offers it alternative rhythms, criteria, and modes of observation. At the same time, science can provide tools and conceptual frameworks that help contextualize and protect such knowledge in the face of colonial, extractivist, or technocratic threats. Situated biodesign practice—as proposed in this study—draws nourishment from this intersection: it does not seek to domesticate ancestral knowledge, but to learn from it, cultivating a fertile space in which different modes of knowing may coexist and flourish.

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5.2 Observation and Care as Pathways Beyond Modernity

The artisans' practice of literally "listening to the cuia" invites those who work with living organisms to engage differently with their subjects and contexts. Anthropologist Anna Tsing, known for her "more-than-human" research with mushrooms, emphasizes the importance of the "arts of noticing":

"Noticing is my way of opposing a particular modernist practice of looking towards an imagined future. (...) we develop blinders so that all we can see is our trajectory towards

one kind of imagined future, (...). Noticing is trying to take those blinders off to look at the world around us, with special attention to the more-than-human world, by which I mean the human plus non-human world". (Tsing & McGuirk, 2024)

Among cuia artisans, this attention is reflected in how they refer to their work: "caring for the cuias" ("*cuida em cuia*" or "*cuida na cuia*"), as mentioned by Martins (2024). As noted earlier, the medicinal uses of the cuieira also render it "the tree that cares for humans" (Moreira, 2020, p. 159).

Care, much like noticing, signifies deep dedication and attention. Tony Fry (1995) promotes intentionality of care in objects, emphasizing that craftsmanship embodies "knowledge of materiality, care in creation, and the quality of what is made" (p. 207). Similarly, Arturo Escobar (2024) suggests that principles of relationality and care may help transcend modern structures. He conceives design as a praxis of transition between narratives, fostering what he calls "pluriversal contact zones"—spaces where relational (emergent) and non-relational (dominant) stories of life and world-making intersect. By moving within these spaces, the work of (bio)designers can significantly contribute to a multispecies approach.

Another important point concerns ethics in biodesign, which emerges as a central issue in the growing collaboration between designers and living organisms. Unlike industrial practices that often treat living matter as a manipulable resource, biodesign demands a posture of listening, co-responsibility, and respect for the temporalities, needs, and agencies of nonhuman beings. Such an approach implies expanding the ethical field beyond anthropocentrism, recognizing the intrinsic value of living systems and the interdependence that connects us to them. Puig de la Bellacasa et al. (2023) propose an ethic of care encompassing both humans and nonhumans, emphasizing that to care is to sustain, continue, and repair our world so that we may live in it as well as possible. In the Amazonian context, this ethic intertwines with ancestral practices that already operate according to principles of reciprocity and respect for life. Thus, an ethically committed biodesign not only innovates in techniques, but also proposes other ways of living and designing with the world, rather than merely upon it.

6. CONCLUSION

This study, centered on the Cuia Colab project, demonstrates how ancestral knowledge can contribute to a profound transformation in biodesign practices. By accompanying artisans from the Amazon region in the production of cuias—containers made from the fruit of *Crescentia cujete*—it was possible to observe a form of knowledge rooted in sensory perception, listening, and care. The practice of "listening to the cuia," which involves attentiveness to the fruit's subtle signals to determine its maturation, proved to be a powerful metaphor for a design practice more attuned to the temporalities of organisms and the rhythms of the ecosystem.

This approach directly challenges modern logics of standardization and efficiency, proposing instead a relational ethic that recognizes the singularity of each tree, fruit, and context. Traditional knowledge, far from being a remnant of the past, acts here as a vector of ecological innovation and cultural resistance.

By integrating this knowledge into biodesign practice, we propose a transition from human-centered design to multispecies design—more attentive, careful, and committed to the interdependencies of life. This articulation between the ancestral and the technological points

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toward pluriversal futures in which design may operate as a practice of listening, collaboration, and regeneration.

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ENDNOTES

1. The ethnographic research protocol included the informed consent of the artisans, as required by the local Brazilian institution SisGen — the National System for the Management of Genetic Heritage and Associated Traditional Knowledge. The SisGen certificate for the Cuia Colab project is available upon request to the authors.
- 2 A video with the artisans performing “how to listen to the cuia” is in the link:
<https://youtu.be/2AuPfkq0mOg>
- 3 After the visit, we revisited Ferreira’s eighteenth-century treatise, which also mentions the need for interaction with the tree to determine the maturity of the cuia; however, the archaic language made a full interpretation of this reference difficult.

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