Territorial Generative Identity as a Tool for the Bioeconomy: Enhancing Agroecological Value Through Context-Specific Design Systems

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Abstract

This project introduces a participatory generative identity system that is part of a design strategy action to support agroecological value chains in Brazil's Atlantic Forest—one of the world's most biodiverse yet endangered ecosystems. Focusing on the Juçara palm (Euterpe edulis), a symbol of sustainable transition, the system blends computational and strategic territorial design to add cultural and economic value to local products and commercial chains. Developed using p5.js and p5.brush, producers can generate flexible, context-reflexive visual identities based on modular elements drawn from local fauna, flora, and culture. These components follow DNA-based generative branding principles–variation in color, shape transformation, repetition, and composition to reflect the context of place. Users access the open-source tool via an online interface to customize layouts and adjust graphic variables. Currently in the middle of the project, beyond the intended functionalities of design software, the research explores emergent behaviors such as community ownership over identity, novel product uses like the fruit-based product over palmito extraction, and new geographical indications facilitated by a shared visual language.

Keywords

Generative design, Territorial design, Agroecology, Atlantic forest, Juçara Palm, Euterpe edulis, Bioeconomy, Geographical indication, p5.js, Flexible visual systems, DNA generative identities [1]

1. Context

The Atlantic Forest, a biodiverse and endangered ecosystem, sustains 70% of Brazil's population and 80% of its GDP [2]. In Paraná, deforestation persists, highlighting the need for sustainable strategies. This project strengthens local bioeconomies in Morretes, Antonina, and Guaraqueçaba by valorizing native products. The Juçara palm *(Euterpe edulis)* serves as a case study that showcases ecological and strategic value, shifting from palm heart extraction to fruit harvest [3], which the project aims to emphasize.

2. Approach

The generative design functions as the channel through which the narrative of E. edulis is represented. The visual identity will adhere to what Felsing describes in her work as 'context-reflexive,' meaning it borrows and reproduces cultural and geographical features of a specific context [1]. This will be primarily expressed through elements from the Atlantic Rainforest, both non-living and living fauna and flora from the moodboard in Figure 1.

These elements can be combined in various ways, resulting in unique outcomes each time, which Nes categorizes as the 'DNA' type of generative identities [5]. A more in-depth study informed boundaries on defining the dynamic nature of the DNA. From the identified categories, four were selected: color variation, combination, shape transformation, and repetition [4], displayed in Figure 2.

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The system adopts the chalk-texture aesthetic used by existing regional initiatives like VRS (Sustainable Regional Vocations of Paraná) as in Figure 3, enabling future compatibility with existing regional efforts, as a strategic ally to leverage the project.

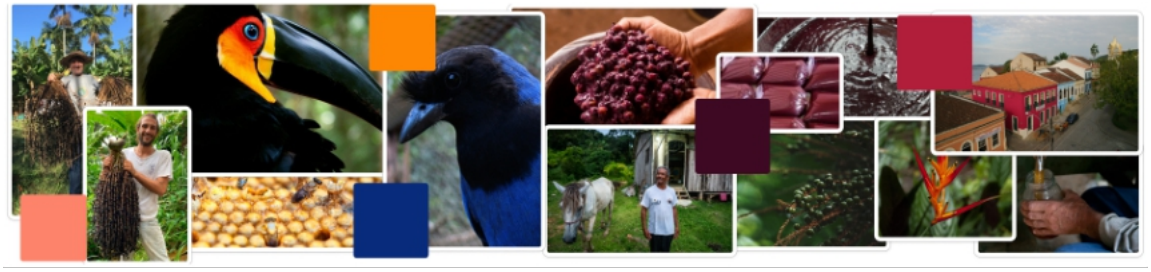

Figure 1: Part of the moodboard that inspired the creation of the symbols and colors.

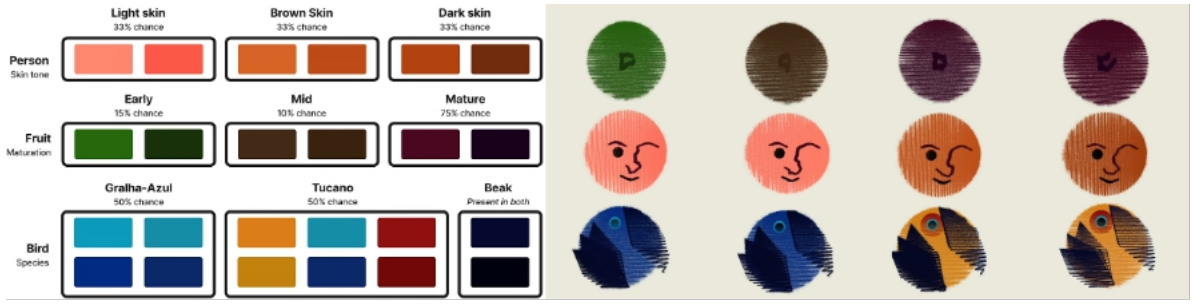

Figure 2: Color and shape variations applied in functions and its generated results.

Figure 3: VRS project branding in their own communication or in partnership with Airbnb.

3. Results

A proof-of-concept generative identity was developed using p5.js and p5.brush. Each of the elements — the fruit, the bird, and the person — shared common layers: background fill hatch, texture hatch, circle coordinates, and special features, colored with RGB interpolation, and slight coordinate perturbations. Each of these layers are separated in different functions with they own settings:

– **Background fill hatch:** A function that utilizes the full spectrum of colors from a given element and the circle's radius to determine the hatch's spacing and size. It uses a custom charcoal brush for its execution.

– **Texture hatch:** Similar to the background fill hatch, but with more spaced lines. It uses a customized hatch brush, colored in random darker shades derived from the background fill hatch color.

– **Circle coordinates:** These function as containers for the hatches, enveloping the lines within circular shapes. Each circle is formed by four rounded vertices, creating an overall circular appearance. Due to the generative nature of the VI, slight variations in the x, y coordinates of each circle result in unique shapes every time.

– **Special features:** Each element has its unique features with distinct drawing mechanics. For instance, birds have beaks and wings that are unlike the features of a person. Separated by each JavaScript file, these parts were drawn from the center of the circle coordinates, keeping them aligned with the rest of the drawing.

These elements are modular and combined through user-selected parameters, displayed in Figure 4, like size, spacing, and label.

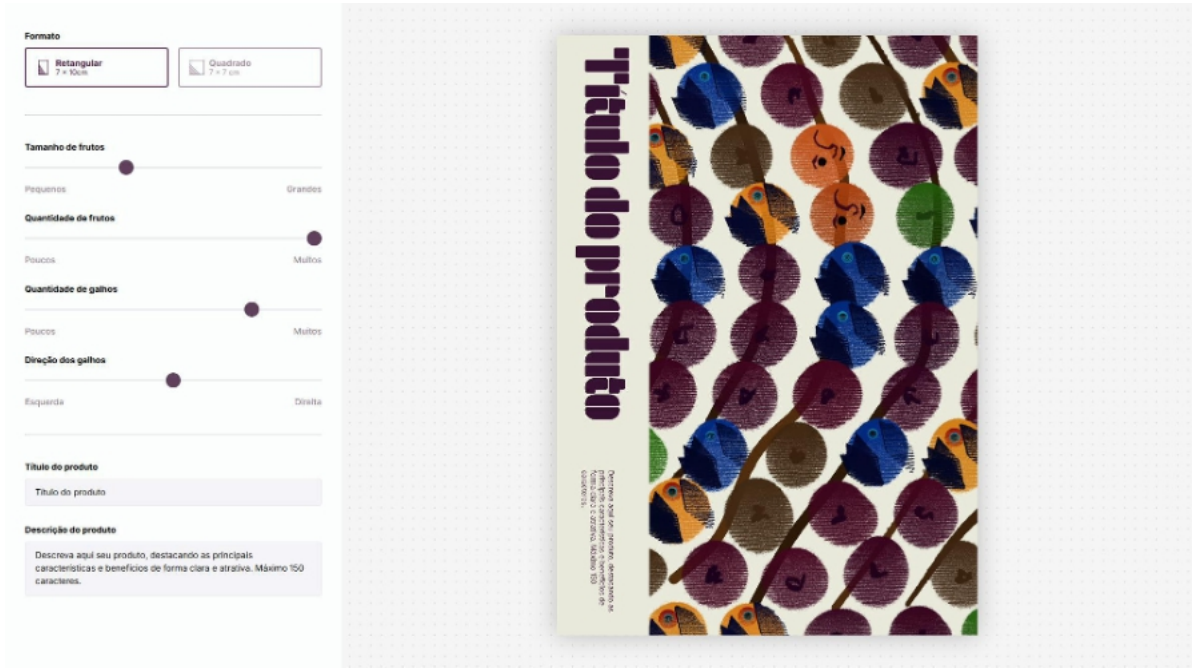

Figure 4: An example of inputs and outputs of the open-source generative platform.

With the generative approach, different producers could generate their own styles while still being part of a group —mobilizing the territory collectively to communicate using a shared 'tone of voice', as in Figure 5. This empowered the community to begin organizing toward acquiring a

geographical indication, transitioning to a more strategic territorial design using packaging as the interface. Enabling producers to tell more of their identity and consumers to have a better understanding of the local bioeconomy [3] through a generative packaging builder that uses the visual identity as a first proposal.

The project used COLIPA as its case study. After sessions, visits, and interviews with their producers and consumers, the project developed new versions that aligned with the territory's organizations, were displayed at the biggest organic food fair in Latin America, as in Figure 6.

With the support of institutions and local producers, the project has reached the first step of its goal: promoting existing products through a new interface. It marks a transition from the sale of unpackaged goods to a democratic packaging system that communicates both territorial identity and the individuality of each producer through their visual markers, as shown in Figure 7. This effort is part of a broader movement that this project will continue to build, to build a territorial strategy that fosters coordination and promotes new value chains.

Figure 5: Multiple iterations of the visual identity using the generator displayed in Figure 4.

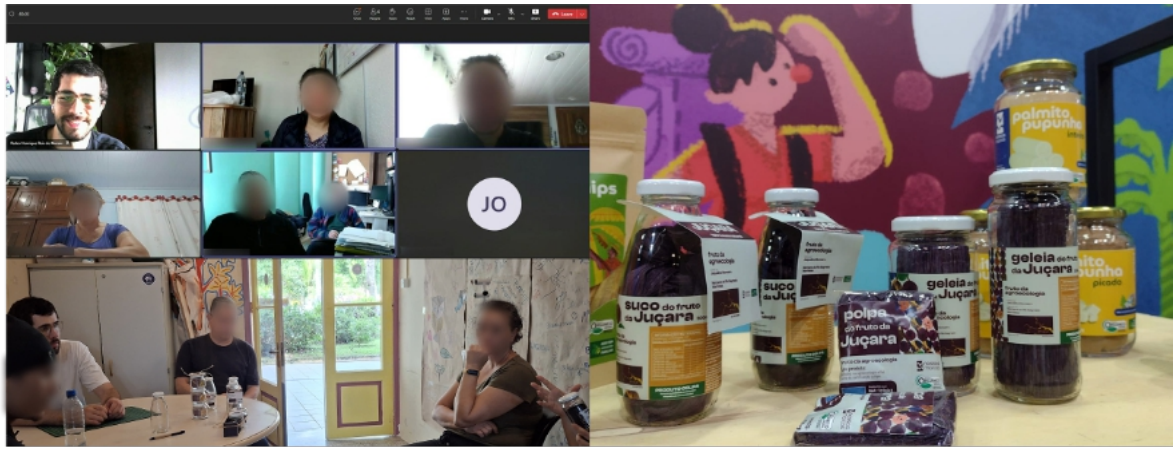

Figure 6: After multiple co-creating sessions with COLIPA, online and at the 'Festa da Juçara 2025', we displayed the prototype using the visual identity at Natural Tech 2025.

Figure 7: An example of inputs and outputs of the open-source generative platform.

After the first iteration, the project entered a new phase of evolution. COLIPA, now deeply engaged, began to recognize the communicative potential of expressing both the values of their territory - the Atlantic Rainforest - and their own collective identity. Through three participatory co-creation sessions, the project developed a new brand identity specifically for their group, rooted in a more nuanced understanding of their needs, aspirations, and local narratives.

Transitioning to the new visual language, the identity maintained its generative essence through the modular elements - the cooperative's name, the birds, the flower, the palm tree, and the mountain, which can be represented in many different ways and colors, reflecting the product that it is applied to, from digital assets for social media displayed on Figure 9 or for packaging purposes like in Figure 10.

Figure 8: New modular generative identity presented by the author.

Figure 9: COLIPA represented for social media/digital assets..

Figure 10: Generative packaging varying by color and repetition.

However, the key transformation occurred in the medium of interaction. What had initially existed as a digital experience evolved into a tactile and analog one. The members began experiencing the generative identity through stamps and stickers, applying them across diverse surfaces and products, creating a tangible layer of authorship and personalization.

At present, the project's scope has expanded beyond the Juçara to encompass the broader context of the Atlantic Rainforest from the perspective of COLIPA. The digital platform is being recoded to reflect the new generative nature of the cooperative's visual identity, ensuring that the packaging system evolves in tandem with the cooperative's growing use and ownership of the identity. More importantly, the process has reshaped the cooperative's perception of design itself - to a strategic asset capable of strengthening their mission: to preserve the forest while empowering family-based agroecology.

Figure 11: Co-creation and experiential workshop with COLIPA producers exploring the identity.

The main conclusion drawn from this experience - both for the author and for the broader creative coding community - is that generative uniqueness and identity need not exist solely within lines of code. In this context, each module's individuality can also emerge through physical expression: the way a sticker is placed, the pressure of a stamp, or the density of its ink can all become new variables in the system. These tactile nuances expand the variability, introducing fresh parameters for variation and authorship.

Ultimately, code becomes just one of many channels - alongside stamps, textures, and gestures - through which generative identity can manifest. For designers, this underscores a crucial lesson: the representation of a project's goals must align with the community it seeks to empower, allowing design to remain both technically adaptive and socially grounded.

Declaration on Generative AI

During the preparation of this work, the author(s) used GPT-4.0 to: Translate, grammar, and spelling check. After using these tool(s)/service(s), the author(s) reviewed and edited the content as needed and take(s) full responsibility for the publication's content.

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Online Resources

The project can be accessed at https://github.com/phrm000/ldc-jucara.