Listening to Amazônia Verde Viva: Transmorphic Intersections of Ecology and Music Technology in the Global South

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Abstract

This paper investigates *transmorphic music*, a form of composition with animal voices created by Brazilian musicians Albery and Thiago Albuquerque, focusing on their 2021 work "Amazônia Verde Viva". Through interview with Thiago, we link the work and its composition to broader debate about the borders between human, non-human, and technological voices in the face of climate change and ecological destruction. In artistic practice with novel technologies, this work contributes the (1) principle of transmorphic interaction and attunement to non-human voices and musical interfaces, and (2) alternative approaches from the Global South to the use of audio technologies in anticolonial and perspectivist practices in dialogue with animal collaborators.

Keywords

ecological sound art, transmorphic music, Anthropocene, climate change, non-human voices

1 Introduction

Although sometimes denied, neglected, or ignored, climate change is here and both discussed and problematised by journalists, theorists, and activists. While Latour [57] and Morton [75] come from Western academic traditions and discuss the political roots of climate collapse by media, state governance, and philosophy, Krenak [54] offers a critical view of the capitalist roots of environmental devastation from an Indigenous perspective. At the centre and intersection of different movements, artistic practice has emerged as a powerful tool for resistance, communication, and awareness of the global climate crisis.

Namely, *environmental art* [48] and *ecoartivism* [17]—based mainly in visual media such as photography, painting, and sculpture—see aesthetics as a way to bring the issue closer to urban environments and citizens. In the audio domain, *ecological sound art* [43] and *environmentalist sound work* [14] frame sound-based projects around climate change. These works encompass different sonic expressions that both seek to raise awareness and action against the collapse of the planet, and also to develop a philosophical-anthropological standpoint on the crisis and its effects in global and local scales. The New Interfaces for Musical Expression (NIME) community has contributed to this domain, exploring for instance sonification and perception of environmental data to connect listeners with the climate crisis [68].

Although scholars have outlined conceptual characteristics of ecological and environmental sound art, technological rationale and incorporation in artistic practice is often left aside. Most work within the NIME context focuses on data interpretation through sonification, leaving questions of how music technologists and interaction designers can conceptually constitute approaches to non-human voices and entangled relationships between nature and creative practice. We engage with this gap, offering reflection on how technology is framed in *transmorphic music*, a set of practical and theoretical concepts developed by Thiago and Albery Albuquerque, musicians from Pará, a state in the North of Brazil.

The Albuquerques' work has received attention both in Brazil and internationally from biologists and those working in climate action. Transmorphic music is a way to *compose with* vocalisations of animals, creating genres or "schools of music" [29]. By collecting, analysing, and decoding vocal patterns, the musicians point to a novel way of interacting with animals in a sonic level.

Since the 2000s, the Albuquerques have released albums and books about their music system [4]. Here, we analyse their 2021 release "Amazônia Verde Viva" (*Green and Alive Amazon*), focusing on its voices and arrangements.[1] Along with an exploratory interview with Thiago Albuquerque, we focus on how the musicians' insights can bring political human and non-human voices from the Global South to suggest initiatives for ecological work at NIME.

Here, we see the term *Global South* simultaneously as "a geopolitical area, a global economic process, a collective actor, a discursive event, and a body of theories, paradigms, and texts" [96, pg. 3]. It highlights complex relationships while simultaneously challenging stereotypes associated with countries outside the so-called "developed world". In that sense, the Global South and sound can be thought of as an alternative to a precarious, colonial, and neoliberal modernity [67, 94] and, also, an effort to build a "Southern-focused corpus" [91].

Furthermore, we engage NIME's Environmental Statement [27, 68]—"Every action we perform, including research, has an impact on our ecosystem"[2]—and contribute to the growing push

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[1] See Table 1 for a full overview of the album.
[2] https://www.nime.org/environment/

against techno-solutionism in music technology and Human-Computer Interaction (HCI) broadly [58, 73]. This paper addresses the polyvocality of human and more-than-humans at the centre of the climate crisis by learning from the Albuquerques and their transmorphic approaches as a means to connect through and beyond the individual into new creative forms.

The main contributions of this paper are to show, with examples and empirical accounts from the composition of "Amazônia Verde Viva", (1) the technical processes and principles that guide the development of a transmorphic composition, and (2) how perspectives from the Global South employ a wide variety of sound and music techniques to build non-conventional *environmental* and/or *ecological* sounds, challenging technocolonialism [21] and creating acoustic forms of perspectivism [22].

2 Background

2.1 The Eco, The Art & The Activism

The climate crisis encompasses several fields of knowledge, from biology and physics to the humanities. During the 80s and 90s, *environmentalist art* emerged through poetry, prose, visuals, and performance art. Joseph Beuys's "7000 Oaks" (1982) [13] and Helen and Newton Harrison's "Making Earth" (1969-1970) series [48] utilised aggressive approaches and reforestation, to engage the public on ecological and social issues. More recently, in "Polish Mothers on Tree Stumps" (2017), Cecylia Malik pictured herself and other mothers breastfeeding their children in front of deforested areas [31], calling attention to the connection between sexism and ecological issues and the co-dependence between humans, newborns, non-humans, and lands.

To Verónica Blanco Perales, the term *ecoartivism* encompasses a "small space of resistance" [17, pg. 115], but has a huge ecological and pedagogical potential. It can be adapted to demonstrations, performances, and classrooms to foster environmentalist awareness. Blanco [17] demonstrates this through "Ecology of an Embrace" (2018), a performance based on the Chipko women in India, who embraced Khejri trees to protect them from being cut down by Jodhpur soldiers and were thus killed [26]. They became a symbol of pacifism and embrace "as a combat tool" [17].

However, ecoartivism's [17] approach to the Anthropocene isn't "mute". Along with visual and textual information, sound becomes another way of showing environmental relatedness.

2.2 Sounding the Anthropocene

The Anthropocene marks an era of human impact on Earth at geological and existential levels, showing the aftermath of centuries of colonialism [60]. To address the resulting climate crisis and disconnect from nature, designers and artists have examined ways to "unseat humans from the center of the universe and support a more equitable gaze" [60, pg. 728], bringing attention to more-than-human experiences [15, 16] and developing kinship with other life in our struggle for survival [18, 47]. Engaging sound, artistic approaches have emerged to generate this understanding:

Roger Payne's album "Songs of the Humpback Whale" (1970) [81] inaugurated an "ecological listening" to non-human voices in the Western hemisphere. It played a key role in the movement to stop commercial whaling and inspired the 1975 Greenpeace campaign "Save the Whales" [46]. Since then, a growing scholarship has addressed the relation between sound and the Anthropocene.

Gilmurray [43] established an *ecological sound art* genre. Talianni [93, pgs. 62-75] investigates how soundscape compositions use "audile techniques" to embed "ecocritical listening" [pg. 72] and foster new forms of political action. In a different approach, Ochoa Gautier [79, p. 29] "listens to" a nineteenth-century Colombian bibliography to identify colonial politics that framed Indigenous and mixed-race (*mestizo*) peoples as incapable of voicing, something that "brings to the foreground alternate histories for narrating" the Anthropocene.

Notable sound art works include David Dunn's focus on unheard sounds and direct intervention on biological imbalance in "The Sound of Light in Trees" (2006) [36], while Andrea Polli's "Heat and the Heartbeat of the City" (2004) incorporates data sonification of urban landscapes [84]. Other ecologically-engaged sonic works that inspire our research are noted in Appendix A.

Despite its role in sound art, the relationship with technology in ecological practice is less explored. Digital methods of recording and making meaning out of environmental sounds and non-human voices are inherently entangled with artists' [anthropomorphic] conceptualisations [74, 85], executed through the aesthetics of digital tools [69]; for instance, creating human-understandable syntax of birdsong via sonography and spectrogram analysis [64]. Whether it produces a extent of influence or not, it is important to understand the agency of sound techniques and technology in artistic and scientific attempts of building what is seen and heard as "nature" [8, 10, 11].

2.3 Ecology-Oriented NIMEs & HCI

In a 2021 systematic review of the NIME corpus, leading to the creation of the Eco Wiki,[3] Masu et al. [68] reveal that ecologically-oriented work in the community focuses mainly on environmentally sustainable practices in the development of NIMEs. There is less focus around NIMEs as social mediators, with only six works within the theme of "raising awareness of ecological and environmental issues". These works mainly use climate or ecological data sonification, with five delving into the climate crisis specifically [63, 65, 86, 90, 92].[4]

In the wake of the COVID-19 pandemic, works have engaged real-time field recording to support reconnection with nature after separation and isolation, a form of nature spectatorship [35]. The incorporation of in-situ reconnections [59] with nature through soundwalks and spatialisation has also been prominent [15, 18, 45]. These methods have been used in other HCI and artistic practice to employ field recordings, soundscapes, and other in-context sensory experience as a way of understanding and connecting with a place [41, 51], rather than simply gathering samples and data [18]. These narratives draw from documentary and ethnographic processes to understand the ways places are inhabited by human and non-human subjects alike; it is a collaborative and interactive method of understanding life [93].

Ecological connection is further strengthened through connection in community and the development of collective "environmental kinship." [12]. In other forms, sonification and sonic interaction employed in NIME and adjacent HCI research have been used to translate slow and silent environmental processes to the realm of human experience [12, 92], convey the impact of climate change on non-human experiences [44, 70, 80, 97], and capture shared experiences to break down dualistic thinking between human and nature [15, 42, 52]. Continuing to incorporate more-than-human experiences in addressing the climate crisis,

[3] https://eco.nime.org/

[4] The original text states only four of the works focus on the climate crisis [68], omitting Driftwood [86]; however, we include the work here as the sonified sculpture directly implicates human actions their role in the climate crisis according to "the amount of value we place on the world in which we live."

designers have also adopted practices of *noticing* [61] and attunement as post-human practices to counter anthropocentrism [16].

While obviously crucial that NIME engage with sustainable instrument design practices, especially in the development and prototyping of electronics [73], there remains to be seen a critical engagement with lived experiences and sociocultural factors in the climate crisis [49, 50]—something, we argue, *transmorphic music* can teach. The importance of intertwinement of ecological, artistic, and creative approaches to engagement with non-human experience cannot be understated [33]. Artistic installation and music presented at NIME have incorporated ecological sound for creative interaction [87, 95]; for instance, we discuss Rojas Vargas [87]'s "Soundmap of the Iguazu River" further in Section 2.4.[5] Adding to these approaches, this paper introduces perspectives and artistic practice from the Global South as alternatives to strengthen polyvocality of experience and engagement with diverse knowledges [49, 67].

2.4 Ecological Sound in the Global South

As much as the "Global South" is an unstable and multiple category [96], so are the sonic practices in its regions. For instance, anthropologist Feld [38]'s idea of acoustemology is fostered during an ethnography with the Kaluli people in the rainforest of Papua New Guinea [37]. The album "Voices of the Rainforest" (1991) was recorded and produced in partnership with the Kaluli through Feld's method of dialogical listening and editing. It emphasised their deep interconnectedness with the ecosystem and non-human beings, thus materialising Feld's methodological and theoretical idea of sound as a post-humanist form of knowledge.

As Chattopadhyay [25] states, practices from these geographies fundamentally challenge Western concepts of linear temporality by embracing cyclical, atemporal, or extended durations that resist "recorded time" or organisational constraints of modern technology [19, 20] or communication techniques [56]. These practices defy Western "disembedding" of sound from its environment [25], proposing an enmeshed rather than extractive dialogue with nature.

At NIME, Jaime Rojas' "Soundmap of the Iguazu River" [87] is aligned with the conference's 2022 theme of *decolonising musical interfaces*.[6] Built from open source libraries for audio (Gibber) and mapping (Leaflet), the artwork sees health benefits and potential for "identity and memory" in the body of water situated in Paraguay, Brazil, and Argentina. Rojas also stresses how these colonial borders suffocate a river in "terminal state" after several years of pollution and use of agrotoxics.

Perspectives and practices from the Global South provide alternative directions for engaging with "wicked" problems, such as climate change, that have emerged from predominant technosolutionism and approaches [9, 50, 67]. Rethinking innovation and Indigeneity as (falsely) contradictory directions [78], Latin American (LATAM) contributions at NIME provide plural realities and epistemologies [50] to challenge the colonial and capitalist hegemonies in digital design and technology development [9, 20, 94]; in the case we present here, the contribution is neither a novel interface or design approach for hardware or software, but the meanings and ideologies artists and practitioners imbue on their technologies. In short, we contribute to this body of research by introducing the Albuquerques' *transmorphic* approaches for engaging human and non-human voices in ecological sound practices.

[5]Music Proceedings from the NIME Conference were not made available until 2025 and so were not included in Masu et al.'s review [68].
[6]https://www.nime.org/web_archive/2022/

3 Transmorphic Encounters: Listening to "Amazônia Verde Viva"

We reflect on the Albuquerques' transmorphic music through a brief analysis of the album "Amazônia Verde Viva" [5] and an interview conducted by first author, Ribeiro Fonseca, with Thiago Albuquerque in 2024. It is important to note:

(1) The interview was part of the first author's becoming acquainted with ecologically-engaged artists in Brazil, aiming to get closer to practitioners and their motivations;
(2) The interview was manually transcribed. Topics such as technocolonialism, software negotiation, and more-than-human voices were then highlighted (see Section 3.2); and
(3) As co-authors, Albery and Thiago have active voice in the construction of this paper. However, the interview captures Thiago's perspectives only. Future research and interview with both the artists will deepen the subjects discussed here (see Section 4.3).

For now, from this starting point, we add new rationale and techniques to the ongoing discussion regarding musical interfaces and environment in Latin America and share alternative approaches in more-than-human composition.

3.1 Listening to "Amazônia Verde Viva"

"Amazônia Verde Viva" (2021) [5], is part of 40-year research project (Figure 1): In 1987, Albery Albuquerque began to investigate animal vocalisations and create compositions from their patterns, an approach he called *transmorphic music* [29]. In 1999, Albery and his son Thiago received a scholarship from the Pará Institute of Arts (IAP, in the Portuguese acronym), resulting in the publication of a kit with five books and a double CD called

Figure 1: Album art for "Amazônia Verde Viva", depicting the outline of a sabiá-branco (*Turdus leocomelas*) full of images of other animals native to the Amazon.

	Track	Link	Duration	Voices	Instruments	Additional Info
1	A Flauta E O Curió *(The Flute and the Curió)*	[♪]	2:47	Curió (*Oryzoborus angolensis*)	Keyboards → Cello → Flute	Conceptual unit. The album starts and ends with the same bird.
2	Base Rítmica Sabiana *(Sabian Rhythmic Basis)*	[♪]	4:12	Sabiá (*Turdus rufiventris*)	Acoustic guitar → violin → flute	Ascending style culminates on an "Indigenous" chorus.
3	Bom Dia Uirapuru *(Good Morning Uirapuru)*	[♪]	4:00	Uirapuru (*Cyphorhinus arada*)	Bells → Keyboards → Acoustic Guitar → Flute → Cello	A morning song, wishing "Bom dia" to the companion uirapuru.
4	Clavenário Silvestre (see Section 3.1.2)	[♪]	14:30	Onça (*Panthera onca*) → Cigarras (Cicadas/*Cicadoidea*)	Drums → Acoustic guitar → Piano → Xylophone → Percussion	Onça's roar mixed/combined to low-pitch percussive instrument.
5	Elementais *(Elementals)*	[♪]	9:27	A flock → Human low-pitched voices → Uirapuru → Indigenous repeated chants	Keyboard → Rain samples → Electric Guitar → Low-pitched synth → Samba percussion set	Depicts late afternoon rain, a common moment of the day in the Amazonian regions.
6	O Balanço Do Curió *(The Curió's Balance)*	[♪]	2:12	Curió (*Oryzoborus angolensis*)	Tambourine → Keyboard → Synth	Combination of samba with atonal melodies, weaved together.
7	Oryzoborus (the curió's family/genus)	[♪]	3:29	Curió (*Oryzoborus angolensis*)	Waterfall samples → Distant low-pitched animals → violin and cello samples → Horns	The music ascends pitch after pitch. The album starts and ends with a curió.

Table 1: The tracks from *Amazônia Verde Viva* and their key voices (→ indicates a chronological progression).

"Timbres da Natureza Amazônica" (Sounds of Amazon Nature, Figure 2) [4].

CD 1 is composed of analyses of the three songs performed on CD 2, entitled *Oração de Floresta e Rio*, *Canto da Natureza*, and *Floresta*. Book 1 conveys the thesis of the project, Books 2-4 the orchestral scores for the three songs, and Book 5 the synchronised and simplified music scores. Together, they shape the basis of Albery's research and practice [4].

Following this and other releases, including "Amazônia Verde Fauna" (2015) [1], a single version of "Timbres da Natureza Amazônica" (2017) [3], and "Amazônia Verde Viva" (2021) [5], the Albuquerques' work received national and international attention from ornithologists [66], international radio [6], and documentary [76].

Discussed in Section 2.2, digital tools, conceptualisations, and disciplinary approaches to ecological sound shape the aesthetics of sonic practice [69]. The Albuquerques' transmorphic process offers a compositional perspective in juxtaposition to the more techno-scientific approaches to animal voice [64], focused on co-creating, rather than classifying voices.

Figure 2: Albery and Thiago Albuquerque's educational Method Kit for "Timbres da Natureza Amazônica", consisting of two CDs and five books outlining transmorphic methods to experimental music [4].

3.1.1 Transmorphic Music. *Transmorphic* means the transformation "through and beyond" matter. It encompasses living beings down to atomic entities and allows for supposedly infinite combinations and recombinations of their musical and aesthetical aspects [4]. Transmorphic *music* is a set of scientific-musical languages that can be decanted and combined to other human and non-human languages; according to the Albuquerques, it is even possible to aggregate elements from the same language (e.g., birds of the same species).

For example, one can *create* standard vocalisations based on birdsong, "counterpoint the bird's language with a another human language or animal vocalisation", utilise "each one of the musical elements (rhythmic cells, intervals, texture, glissandos, etc.) that compose the standard structure of the vocalisation and make them interact between themselves" [4]. "Amazônia Verde Viva" works with Amazonian birds including the uirapuru (musician wren), curió (chestnut-bellied seed finch), sabiá (rufous-bellied thrush), and saracura (slaty-breasted wood rail), and mammals like the guariba (brown howler monkey) and onça (jaguar).[7]

In short, the route of transmorphic composition is animal-human rather than the opposite. Its process is based on researching and/or recording sounds that, although far removed from the "psycho-emotional elements" of the human universe, have aspects that can contribute to human music-making [30].

3.1.2 Non-Human Voices: Uirapuru and Clavenário Silvestre. Listening to the album was important to complement the bibliography research about the Albuquerques' work. The album is summarised in Table 1. We specifically explored tracks 3 and 4, *Bom dia Uirapuru* and *Clavenário Silvestre*. From a descriptive point of view adopted by Ribeiro Fonseca and Reed, these songs summarise the Albuquerques' transmorphic music.

Bom dia Uirapuru. The song starts with bells and the uirapuru's chant, repeated several times. The acoustic guitar takes over, assuming the same patterns full of glissandos. After, a flute

[7] In this paper, we address these animals with the Portuguese names they are addressed by in Brazil.

Figure 3: Thiago's Logic Pro arrangement showing the arrangement of voices equalisation choices as he works with the uirapuru's voice for the track *Base Rítmica Sabiana.*

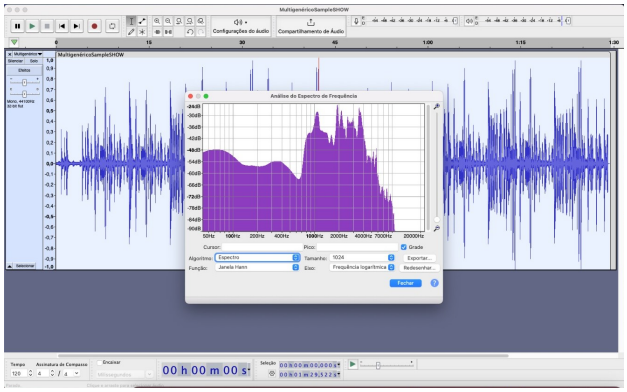

Figure 4: Thiago's Audacity arrangement showing the analysis of spectrograms. This was a generic sample, unconnected to a specific track.

and cello alternate between solos. In the last seconds, the acoustic guitar merges with uirapuru's chant, creating a dreamy and idyllic atmosphere.

Comparing the use of plug-ins to mix the uirapuru voice in *Base Rítmica Sabiana*, it is possible to see how "purity" is not a pursued goal. With Pro-Q^3 (Fab Filter), Channel EQ, and Graphic EQ, the musicians are able to *see* and *listen to* the frequencies of birdsongs, choosing to enable some frequencies and hide others (Figure 3). This is supported by an analysis of spectrograms (Figure 4).

In *Bom Dia Uirapuru*, the voice of the bird is enmeshed with flutes and cello samples rendered directly from notation software such as Musescore. On the one hand, the *artificiality* of the orchestral fragments contrasts with the notes emitted by the uirapuru. On the other hand, these notes follow an approach based on composition and altered sounds underneath the uirapuru as the primary voice.

When it comes to birdsong, the uirapuru is one of the most appreciated birds. Its "exceptionally musical" behaviour [34] is expressed in its flute-like voice and the rareness of its chant, heard only 15 days per year in the mating season. Some Indigenous legends describe how the god Tupã turned a warrior into the bird (so he could sing to his beloved one); others affirm that "when the uirapuru sings, all the other animals fall silent" [34] [p. 59]. Modern composers [39, 77] continue to work with the musical and mystical aspects of the uirapuru's voice [34].

Before "Amazônia Verde Viva", Albery had already composed several songs to the bird. In "Amazônia Verde Fauna" (2015) [4], the pieces are enmeshed with a field recording of the uirapuru, often with other birds and rainforest sounds in the background. This is joined by an acoustic guitar, which picks up on and develops the rhythms introduced by the bird.

Clavenário Silvestre. This track is more complex in terms of aesthetic choices and animalistic layering. The name itself evokes a particular quality, combining "Clave" (*clef*, the music notation symbol) with "Santuário" (*sanctuary*) to form "Clavenário" *Clavenário Silvestre* operates as a "suite", i.e., a collection of small pieces that represent an entire compositional unit (in contrast or in correlation with a key) [83]. From a religious and architectural standpoint, Clavenário seems to recreate and merge all the "small parts" of the rainforest into a musical continuum.

The 14:30-minute piece starts with an onça's roar slowly "decomposed" into a percussive sound. Synthesised voices and sounds divide space with a—at first listening—dodecaphonic or atonal serial composition. This atonal "atmosphere" seems to fit an occasional piano and the presence of several birds' chants.

The choice of supposedly "chaotic" or undomesticated sounds is particularly engaging if we have in mind the dilemma stressed by authors such as Mâche [64] and Doolittle and Brumm [34]: are we—and our machines—listening to the "real" frequencies, or are we merely replacing or rendering animals' activities for human-based meaning? In other words, are we keeping an Anthropocentric hierarchy?

As the piece develops, we return to some "normality". The crescendo starts again with a duet between the sabiá and the acoustic guitar in ascending and then descending progressions. Indigenous chants are mixed with animal references. Thiago previously described this creative process [40]:

> [...] when you are listening to our composition, you may think that it is a recording, but no, it is a composition. [...] This is the methodology. Record, write the scores, and map the elements. Only then do we use the animal's voice "above" our composition.

The meaning given to recording and composition crosses discourses and merges different technologies. Is the recording already a form of composition? What type of tools and techniques are behind "Amazônia Verde Viva"? How do they participate—consciously or not—in the sound crafting of the work?

3.2 Technological & Transmorphic Synergies: Interviewing Thiago Albuquerque

To expand on this listening perspective, we incorporate perspectives from composer Thiago Albuquerque. Thiago is a producer and composer. He has worked in music production since 1999 in Belém, the capital of Pará. Starting a partnership with his father was decisive for him to develop an interest in recording, even without the internet in the beginning. When he earned a scholarship at the studio Midas in Belém, he was formally "initiated" and later started an internship there. After nine years, he built his own studio, where he has been installed ever since (Figure 5).

The interview was conducted online via WhatsApp by Ribeiro Fonseca between July and August 2024 and covered subjects such as personal and music trajectory, preferred software, relevance of

Figure 5: Thiago and Albery working in their studio in Belém, Pará, Brazil.

AI to the practice, entanglement between technology and animal songs, and use of field recordings; see Appendix B further.

In this dialogue, we identified:

- How to "navigate" through software and equipment;
- How technology creates bird "voices";
- The idea of "nature" or "natural sound".

3.2.1 Producing & Composing: Two "Worlds", Different Software. The first part of the interview is to understand the types of software and the approach for each one. According to Thiago:

> [...] I've used a lot of software, right? I've used [Steinberg] Nuendo, Cakewalk [Sonar], and Pro Tools. Nowadays I'm using Logic [...]. It has an excellent native equaliser that you can kill the frequency with ease, you can master its parameters there with ease to find the sequence that's bothering you in some element, some percussion, some guitar, something, you kill it very quickly [7].[8]

As a producer, Thiago believes that audio software's main function is to equalise and combine it with plug-ins, e.g. iZotope. The rest is up to "good instruments and good musicians" [7]. Conversely, as a composer, he doesn't like the environment of the studio. Silence, to him, is essential, and can only be found at home and at specific hours. There, he uses MuseScore and FruityLoops (now FL Studio) to process his ideas and write scores.

Firstly, we can see the methods of placement and characterisation of technologies. Although a good and easy program is important to the success of the recording, Thiago highlights that the software is always a means to an end. What counts is the quality of musicians and instruments, seen here as the "true music" – or "non-technological" apparatus.

Additionally, the studio's structure offers *only* a place to record (Figure 5). The inspiration is something conceived outside and with FruityLoops. Although it is not the main focus here, it is important to say that FruityLoops has a huge role in independent music worldwide. More than that, the software's several versions were part of the creation and popularisation of several genres in Pará, such as brega and tecnobrega [24, 32, 89].

Contrary to audiophilia or the idea of one-solution-fits-all, Thiago's position denotes a "free" move among software and plug-ins. The most important thing is the result.

3.2.2 From Non-Human Voices to Established Genres. Through transmorphic music, the Albuquerques connect with the ecological perspective that "tearing one tree down is to tear an artist's house down". In times of devastation and extractivism, the album listens to and interacts with a green and alive Amazon (as the title states). Is it an active choice? What are the sites for that?:

> We also collected, as I said, in the forest, for example, the sound of the guariba and the toucan and other animals, such as the saracura, we collected everything in the forest, but it wasn't a closed forest, it was on the ranch, this ranch was close to the forest. We went there, to a friend's place, and we collected the sound there. We collected the sound of the jaguar from the museum. Sabiá, we collected from right here in Belém. In Belém, there are a lot of Sabiás... it's a species... it's not endemic here, but there are a lot of them here in Belém. [7].[9]

To them, the *transmorphic music* should obey to two important rules: 1) do not plagiarise animal vocalisations, and 2) do not misrepresent "the spontaneous vocal languages" used by both humans and animals [4]. In short, a transmorphic musician could compose any novel piece, as long as it is connected to a "structure" or "pattern".

The sound of non-human animals is enhanced to the status of a "musical genre" or "music tradition" through a series of sound devices: the music sheet, spectrogram readers (Figure 4), and music decodification. The uirapuru, for instance, turns into a *genre*; as much as one can be inspired by Tom Jobim's style of composition and compose a song in Bossa Nova's harmonic

[8]Translation of the original: "Olha, eu já usei muitos programas, né? Já usei o Nuendo, Cakewalk, Pro Tools. Hoje em dia eu estou usando Logic, e vai ser difícil eu mudar porque é um programa muito prático, né? Pra mim ele tem um equalizador nativo excelente que você consegue matar a frequência com facilidade, você consegue dominar ali os parâmetros dele com facilidade de encontrar a sequência que está que está incomodando em algum elemento, alguma percussão, algum violão, alguma coisa, você mata muito rápido".

[9]Translation of the original: "Também colhemos como eu falei, na floresta, por exemplo, o som da guariba e o do tucano e de outros animais, como, por exemplo, a saracura, nós pegamos tudo na floresta, mas não foi floresta fechada, foi no sítio, esse sítio ficava bem dentro da floresta. A gente foi pra lá, o sítio de um amigo, a gente colheu lá o som. Já da onça, a gente colheu do museu. Sabiá, nós colhemos daqui de Belém mesmo. Em Belém tem muito Sabiá... é uma espécie.. ela não é endêmica daqui, mas tem muito aqui em Belém. [...] Agora, a problema com o fazendeiro, nunca tivemos, porque nós nunca fomos pra fazenda pra colher som de animais."

and melodic structure, it is possible to compose based on the uirapuru's patterns.

It is elementary, therefore, to get acquainted with the sound of animals in their "pure" or "spontaneous" form. Only then can you start composing (Figure 6). Thiago and Albery state that animals express sonorities unattached with human ones, and point to a new path for music [29]. To interact with these sounds and *incorporate* their grammar, an exhaustive listening of recordings (produced by the two musicians, biologists, or ornithologists in various sites) takes place. The files are stored in the Albuquerques' archives, in museums, or universities. For "Amazônia Verde Viva", the majority of songs were produced from third-party recordings.

> It's not a simple *imitation of* animals vocalisations. We take it, write the score, and perform it. Based on this study, we write the score, then we decode it and understand the creation process of that species. In other words, we can compose themes within that pattern [7].[10]

3.2.3 Incorporating Animal Grammar with VSTs. Once the language of an animal is understood, one can then compose from it. When the first albums were produced, the Albuquerques didn't have enough resources and it was necessary to record the songs with a guitar and after add the animal's voice.

> For example, Dad created some uirapuru songs on the guitar. He plays the real uirapuru, its voice, and the guitar. When you listen, it sounds like Dad took the song of the uirapuru and played it just like it. But it's the other way around. He created the composition on the guitar, then we took its voice - at that time there was no sound source - separated it into musical scales, and put the voice as a sample - note for note on top of the notes that Dad created [7].[11]

For "Amazônia Verde Viva", Thiago created Virtual Studio Technologies (VSTs) based on animals. A VST is a software interface for audio plug-ins that allows the integration of virtual synthesisers and effects into digital audio workstations (DAWs). VSTs, along with similar platforms, employ digital signal processing to replicate the functionality of traditional recording studio hardware within a software environment. While a sample is an already pre-recorded sound, a VST can provide new sounds in a digital workstation, similar to a virtual synthesiser. Interestingly, both tools are used to bring a more "natural" sound to the musical performance (be it live or in a studio).

4 Discussion

Listening to "Amazônia Verde Viva" and interviewing Thiago Albuquerque reveals tropes that contribute to a broader understanding of how technologies are used and in what way they interact with the human and non-human. The first is the basis behind transmorphic music. The second is how Thiago and Albery disrupt technocolonialism, changing, overlapping, and re-inventing the relationship with audio technologies.

Figure 6: Frame of the Programme *Sonora Pará* starring Albery Albuquerque [2]: " I can vary the musical notes. It's in the rhythm, right?"

4.1 Interaction on the Basis of Transmorphic Music

As Thiago states,

> On our second CD, there was a farmhouse belonging to Dad's friend where he put the CD on, and it was filled with birds around the house. So it's a work that goes beyond art because it has this environmental protection aspect [7].[12]

"Amazônia Verde Viva" and all the other works released by the Albuquerques since the 2000s are the direct result of an intersection between established technological devices, sound archives, field recordings, and a sense of nature that simultaneously shares and counters Western bias toward the human-nature duality.

Interaction can describe the extractivism carried by governments and companies worldwide. For them, interaction means profiting from (apparently) infinite resources, and destroying ecosystems and modes of human living connected to them. However, Thiago's statement relates interaction with other species to a both spiritual and technological attunement. Through transmorphic music, the musicians undermine human exceptionalism, an issue also addressed by other Indigenous and non-Indigenous philosophers and scholars [25, 34, 37, 53, 64].

Although Thiago and Albery highlight the compositional aspect of their music, they frame interaction as something multi-situated (human → non-human → human → non-human), not unidirectional (non-human → human). In short, there is an effort to learn with the other, which entangles a politics of care activated by musical interfaces. This is reminiscent of Livio and Devendorf [62]'s idea of an eco-technical interface in troubling and transcending boundaries between humans and non-humans in technological interaction. At the same time, "Amazônia Verde Viva" appears as part of a "Southern-focused corpus" [91, pg. 5] where listening is mediated through an array of devices that

[10]Translation of the original: "Bom, não sei se tu conhece a *linguagem*, como é que ela funciona. Não é uma simples *imitação das localizações* dos animais, a gente pega e escreve a partitura e executa. Não é isso, né? O que a gente faz? A gente estuda cada vocalização de cada espécie, né? A partir desse estudo a gente escreve a partitura, depois a gente decodifica e entende o processo de criação daquela espécie né? E aí a gente consegue, entendendo a lógica o e o padrão, a gente consegue criar um gênero musical a partir disso. Ou seja, a gente consegue compor temas dentro daquele padrão."

[11]Translation of the original: "Por exemplo, papai criou umas músicas de uirapuru no violão. Fica tocando o uirapuru-verdadeiro, a voz dele, e o violão. Você escuta, parece que o papai pegou o canto do uirapuru e tocou igualzinho a ele. Mas é o contrário. Ele criou a composição no violão, depois a gente pegou a voz dele – como naquela época não tinha som de fonte – separou em escala musical, e colocou a voz como sample – notinha por notinha em cima das notas que papai criou."

[12]Translation of the original: "[Nossa] música interage com a natureza. Se você colocar um uma composição de sabiá perto dos outros sabiás, eles interagem. Existe essa interação. No nosso segundo CD tinha um sítio do amigo do papai que ele colocava o CD e enchia de pássaro em volta da casa. Então é um trabalho que é acima da arte, porque tem esse viés da proteção ambiental".

carry with them the values and ideologies of audio companies, algorithms, and encodings.

4.2 Technocolonialism and Perspectivism

Generally, musicians from different parts of the world use and manipulate devices developed (in their majority) in the Global North. This situation is approached by a concept Castanheira [21] understands as *technocolonialism*, i.e., the standardisation of recording practices and the impossibility of countries and individuals from the Global South to develop their own technologies. The rise of digital tools enhances generalised automation whose aim is to "facilitate proceedings, but at the same time, to standardise a series of practices based on universal platforms" [21, pg. 115]. According to Castanheira, it is very difficult (or almost impossible) to break with the system, condemning musicians from other regions to use mass-produced machinery.

However, the Albuquerques' relation with these devices is not passive or standardised. To counteract technocolonialism, we can apply anthropologist Viveiros de Castro's notion of *perspectivism* to "Amazônia Verde Viva" and transmorphic music, approaching dynamics between human music, technology, and acoustic phenomena led by animals. With perspectivism, Castro [22, 23] seeks to overcome anthropocentrism by adopting Indigenous' perceptions towards the other inhabitants of the world as bodies that can adopt different shapes, but are also capable of agency and discursiveness.

Castro argues that Western thought privileges the mind and soul – associated with rationality and agency – over the body - linked to nature - in determining the status of who is considered fully human and non-human. In the context of colonisation, European countries sent expeditions to assert that the Indigenous had a soul and, after Catholic conversion, could be seen as equals. Meanwhile, Indigenous peoples had drowned their white hostages to see if they could decompose and, therefore, determine if the newcomers were spirits or different animals. The anecdote shows that everything, from an Indigenous point of view, can be people, spirit, and/or animal. The body is a mask or a cloth that carries with it certain aspects that determine habits.

The interchangeability of perspectivism surpasses the *anthropo* (as merely human) to achieve a context in which all creatures exist and are capable of intentionality, agency, and enunciation. Accordingly,

> European praxis consists of 'making souls' (and differentiating cultures) from a given bodily-material background (nature); Indigenous praxis, in 'making bodies' (and differentiating species) from a socio-spiritual continuum given 'since ever' [...] [23, Loc. 375][13]

This standpoint celebrates a plethora of bodies capable of the production of meaning when facing the same material. In the case of "Amazônia Verde Viva", this material is voice. We argue that the album offers a different kind of perspective or audibility in a "sociocosmic field" [22] marked not only by human action but by the agency of birds, onças, VSTs, and samples. Albeit the last word is Albery's and Thiago's (that act as players and judges, deciding whether a voice is legitimate or a song obeys the animal "utterance"), their music-meaning-making process transverses animal sounds, recording, and reproduction devices. This approach highlights Castro [23]'s "making bodies" assumption by creating a "music school" [29] of different animals with musical interfaces. It does not emerge harmonically or in a pristine way, but reinforces other relations (or interactions).

Ultimately, Thiago and Albery don't simply accept the established manual of big audio companies. They manage and create orchestral instruments, both high- and low-fidelity, and make them interact with virtual instruments based on non-human voices. Although the fingerprint of Pro Tools, Musescore, and other software is still present, its semantic relevance is altered from within.

4.3 Future Work

Following this work, ecologically-oriented NIMEs and work with more-than-human voices, can adopt two directions: first, to interweave more-than-human and Indigenous scholarship with musical interfaces, creating possible connections within these two fields, and, second, to incite musicians, performers, and artists to use transmorphic approaches in their works. Our fingerprint as creators will be undeniably there, but a less self-centred perspective can allow new voices to emerge.

The Albuquerques' last work was in 2021. Since then, climate change has worsened, and the Amazon has become a global focus. On future academic endeavours, we aim to interview Albery and Thiago together, deepening the understanding of how transmorphic music participates in socio-ecological politics. One example to be further discussed is the musicians' participation at COP 30 (Conference of the Parties) in Belém [88]. Additionally, we will explore the spontaneity of how human and non-human languages approached on their albums as a necessary challenge to ideas of "purity" and their enmeshment in musical interfaces.

5 Conclusion

The paper presented Thiago and Albery Albuqueque's *transmorphic music* as a compositional act between human and non-human animals in the Brazilian Amazon. Centring their work, spannin from several albums and books, we contribute an account of listening to the 2021 release "Amazônia Verde Viva" and an interview with Thiago Albuquerque held in 2024 to understand how music technology and post-human approaches can support transmorphic creativity. First, we discussed how the work is connected to ecologically-engaged sound and arts movements, both in and outside of NIME. Second, we conducted an analysis of "Amazônia Verde Viva" and identified key aspects in dialogue with Thiago to understanding the technological and ecological values embedded in their transmorphic practices. In doing so, we contribute discussion regarding (1) the principle of transmorphic interaction with (or attunement to) non-human voices and musical interfaces, and (2) the rearranging of audio technologies from the Global North and incorporation of approaches from the Global South, as expressed via Thiago Albuquerque's music trajectory, to support engagement with ecological sound and the climate crisis to the research and artistic community at NIME and beyond.

6 Ethical Standards

The authors have ensured that work undertaken around this project adheres to and upholds the NIME Principles & Code of Practice on Ethical Research.

[13]Translation of the original: "A práxis europeia consiste em "fazer almas" (e diferenciar culturas) a partir de um fundo corporal-material dado (a natureza); a práxis indígena, em "fazer corpos" (e diferenciar espécies) a partir de um continuum sócio-espiritual dado "desde sempre"".

As noted, this research is conducted with consideration of the NIME Environmental Statement in that environmental responsibility not only applies to sustainable instrument design practice but also to the inclusion of diverse voices in our community, to address what is ultimately a global crisis.

> "Every action we perform, including research, has an impact on our ecosystem. NIME is committed to environmental sustainability and conservation in both the delivery of the annual conference and in our day to day research and artistic practices." [27]

Please refer to the complete NIME Conference Environmental Statement at: www.nime.org/environment.

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A Listening Appendix

To instil the debate, we quote other initiatives in the interface of sound, music, and ecology.

"Maria Choir". Although not explicitly connected to ecology, Iván Paz and Lina Bautista's interactive installation, presented on NIME in 2024, uses a timbre transfer model filled with samples of Catalan singer Maria Arnal's voice. It promotes a choir or duo between Arnal and the visitor [82]. Similar to "Maria Choir", Thiago and Albery's transmorphic music utilises technology to challenge what a non-human voice can or should be.

"The Earth Head-On" [28]. Released in 2020, this documentary and sound performance features Brazilian performer Thiago Cóstackz and Icelandic musician Hjörvar Hjörleifsson. Interspersed with formal 'scientific' moments, Cóstackz embodies "The Great Arctic Mother Goes to the Amazon", in which Tuyukas (a Brazilian-situated Indigenous population) dance and play flutes around the performer who, dressed as a representation of the Arctic and Greenland, interacts with the dance.

"Hjirok - The Mother of O' and 'Earth'" [72] and "Nine-Sum Sorcery" [71]. Kurdish singer and songwriter Hani Mojtahedy mixes references from Zoroastrianism with the growing scarcity of water and oil extraction in Kurdistan, particularly in the city of Erbil.

"Healing Sounds" [55]. Shirley Krenak is an indigenous woman born in Brazil. Her nation Krenak, or Borum, has been suffering from the devastation caused by mining companies such as Vale, Samarco, and BHP. Since 2015, due to a failure of a Samarco dam, the Doce River, or *Watu*, in their region, has been considered "dead". In 2023, Shirley released the sound installation "Sons que curam" ("Healing Sounds"). With images, field recordings, and live music, Krenak uses her voice to reinforce the importance of the Indigenous people to preserve ecosystems all over the world.

B Interview Prompts

The unstructured set of questions and topics discussed with Thiago is the following:

(1) Tell us a bit about your career as a musician and producer.
(2) What sort of programmes and software do you use? And for what purposes?
(3) I'm very interested in how human-based technology and the vocalisations of non-humans intersect in the compositional process. How does that happen? Could you tell me a bit more about it?
(4) Do you think the work you do has an ecological or educational basis in terms of your interaction with – what is known as – nature?
(5) How do you source the material used in your compositions? Are they your own recordings, open-access archives...?