

Negotiating temporality: the Biology of Time

Dr. Rewa Wright

Affiliation (s): Queensland University of Technology

Location, Country: Australia

Contact Email: rewa.wright@qut.edu.au

Abstract

The artist duo UnCalculated explore speculative futures where plant signals, human music, computational data collide, in a sophisticated audio-visual experience. Bringing computational data visualisation methods using code and algorithms into contact with the shared cultural cosmology of Rewa Wright's Māori ancestral lines, affords the capacity to weave new speculative futures that challenge Western assumptions about Indigenous culture and the limits of knowledge. This research examines non-linear time and aims to decolonise the narrow field of computational technology by exposing it to the broad and open perspectives of mātauranga Māori, generating a space of diversity and inclusion within the mainstream.

Keywords

Plant communication, Indigenous thinking, phenological time, micro temporality, duration, posthumanism.

Introduction

A pervasive figure in Western scientific as well as artistic consciousness, the 'Arrow of Time' has been a dominant metaphor shaping understandings of temporality. The 'arrow of time' described a concept developed by British astrophysicist Arthur Eddington in 1927, and is an unsolved general physics question that posits time a unidirectional, or going in only one way (Eddington 1946). Eddington used this theory to speculate on the constitution of stars and the quantum process of light emitted by stars. Subsequently this image was used to generally describe the way that time only proceeds in a linear passage, and through the effects of the 'arrow of time', matter is irrevocably transformed into new forms which cannot be reversed. Time is an 'arrow' in the sense that the actions that transform matter through space time cannot be reversed. The arrow speaks to concrete materiality when matter changes state, such as ice melting or an egg being turned into an omelet. Certain modes of matter, once transduced into their new state, cannot be undone.

While this seems logical, it is important to remember that the unidirectional formulation of the arrow is only one possible formulation of time, many others exist from outside of Western epistemology, raising questions about the irreversible status of time's linear passage. Another conception of time is found in the theme of EveryWhen, however it is outside of the scope of this paper to discuss here. Instead, the author will use a system she is familiar with from her own

cultural ancestry: time as spiral. Taking a non-Western approach anchored by the author's First Nations' Māori ancestry, posthuman thought and situated agency, this paper re-thinks metaphors about time as an assemblage of instances, moments, and events.

Drawing on examples from theory and practice, this research attempts to open new pathways through phenological, sea-seasonal approaches as well as micro-temporality and quantum time. Thinking alongside quantum time, we invoke the figure of the chronon, as a fundamental interval of time invoked to "designate elementary particles of time in parallel to the atom in space" (Caldirola 1978). Broadly speaking, the chronon is to time what the atom is to space: an indivisible unit that measure behaviours we cannot visibly see, but apprehend the effects of. Such behaviours include how light might be emitted by radiation and what speed in spacetime that variable would be. Artists working with light are unknowingly manipulating matter and generating effects such as radiation emitted as chronons. In this way, the real-time artwork is manifest as an assemblage of chronons, a small theoretical unit of light which current technology like LCD screen and projectors has in common with the stars. Caldirola's chronon is a model from quantum physics that fuses Euclidean three dimensional space (x, y, and z axis) with time (Caldirola 1978).

Towards multidirectional time: beyond the 'arrow'

Yet, if we think speculatively and alongside Indigenous concepts of time, new models emerge that can fruitfully inform current Western understandings of temporality. For example, in contradistinction to the linear arrow, a spiral is proposed rather than an arrow. Actually a curvilinear geometry derived from nature, examples such as the spiral shaped fern frond, the 'koru' show a physical embodiment of time as spiral. Furthermore, there are many examples of inspiration from biological evolution is modelled the curvilinear forms of Māori art, such as kowhaiwhai.

In traditional carving, an open spiral pattern is called 'takarangi', and it's carved on lintel and bargeboards in the exterior architecture of the whareniui (traditional meeting house), as well as painted in the interior across the spine of the house as kowhaiwhai. Sitting proudly as the focal point of a marae (traditional gathering area) the whareniui is also a figure of time realised through space. Visitors arrive at the waharoa (gateway) on the atea (open area in front of the whareniui) before being brought into the meeting house. Symbolically, as they walk forward into the house, they

leave behind the present, and walk forward into the past. Embedded with culture and customs and knowledge, the architecture, structure and interior of the wharenuī is a living repository of mātauranga Māori (Māori epistemology). It is useful to note here that the regular translation of mātauranga Māori is ‘knowledge’, but for the purposes of this research the author signals an equivalence with ‘epistemology’, since knowledge itself exists in a distinct system of practice, intention, and structure. This passage of the human body moving through the space of the house is encapsulated in the traditional saying ‘ki mua ki muri’ (the past is the future).

Thinking with curvilinearity, another folding of space occurs in a common metaphor for the house itself, which is as the embodiment of an ancestor. Therefore, the architectural structure of the house in some tribal regions is at once also an embodiment of an actual ancestral body. Sophisticated in leveraging meaning and metonymy, many layers of space and temporality fold together in this architectural system. Crucially, this traditional approach is underpinned by a vision of time as multi-directional and layered, where past, present and future intersect. How then, might his conception of time inform contemporary digital media art?

Seeding a Biology of Time

The artwork *He Koiora o te Wa: Biology of Time* (UnCalculated 2023) takes as its theme the concept of non-Western time. Partly realised through the material practice of plant signalling, this installation transposes inaudible electrical signals from living plants into audible frequencies which are visualised as real-time animations. This installation creates a networked situation where plants have agency in the assemblage, and time as biological or phenological is considered alongside time as microtemporal and durational. Attempting to provoke participants to shift their understanding of plants, which may have filtered down from Western conceptions of plants as passive or decorative rather than active and generative, this artwork also encourages new understanding of plants as co-composers in a bespoke networked systems of software and hardware devices. Referring back to the multidirectional concept of time from Māori epistemology, we also find a revealing traditional conception of plants as ancestors. Furthermore, if we think about the structure of living plants as they develop, we find certain plants unfold as spirals, such as the fern frond. The fern frond or ‘koru’, generates an actual spiral shape that unfolds over time: literally, a mode of time as spiral.

Computational data and life force

He Koiora o te Wa: Biology of Time is an interactive installation combining bio-electrical data, real-time animations and living plants, in a poetic and sophisticated experience for a participatory audience. The concept is to reveal the hidden signals produced by living plants, through sonification and data visualisation that brings humans closer to understanding that plants are not simple ‘passive machines’, but that they communicate through energy and a vital life force.

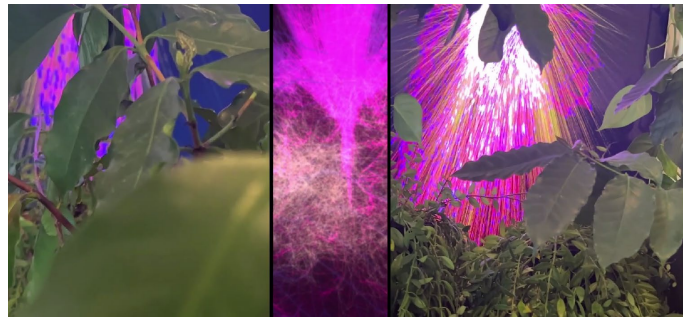


Figure 1. Screen capture from *He Koiora o te Wa: Biology of Time* See the trailer for the artwork at this link:

https://youtu.be/DGSQ94s_wew

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Seasonal time

He Koiora o te Wa can be translated as the ‘biology of time’ in the ancestral language of Rewa Wright, te reo Māori. Looking beyond the lens of Western epistemology and the scientific discourse on plant biology, this artwork examines the complex interrelationships between humans and plants. Drawing on the cultural knowledge system of Wright’s culture, mātauranga Māori (Māori epistemology), plant-human relations can be approached from the perspective of genealogical connections, embedded in bloodlines that co-mingle earth, sea, sky, and water, with human and plant kin. Like humans, plants are considered to have mauri (energy) and wairua (life force). Plant rhythm is phenological, and traces processes such as photosynthesis and osmosis as plants pursue circadian patterns of growth, seeding and decay. The title of this work, *He Koiora o te Wa: Biology of Time*, refers to the different temporality or phenological time and biology of plants vested in seasonal shifts and dependent on temperature, water and light.

Re-framing plants as co-composers or companions in an artistic process, moves beyond the human-centered philosophy of resource extraction, where plants are often seen as ‘passive machines’. Our approach activities an expanded understanding of plant processes by making the electrical signals manifest as sonic frequencies. Furthermore, since audience can touch the plants and shift the frequencies, people gain an understanding of the hidden operations of plants and how we can communicate with them through a sharing of bioelectrical signal energy transduced as aural and visual data. Several plant neuro-biologists (such as Stefano Mancuso and Monica Gagliano) have noted the signals that plants emit are akin to intentional communication and sentience, and this is now a recognized area of scientific study.

Intersectional with such research from evolutionary biology, is the foundational temporal concept of phenology. Phenology is ‘the study of recurring plant and animal life cycle stages, especially their timing and relationships with weather and climate’ (Schwartz 2003:1), so phenological time in plants is based on the biological rhythms of the seasons: the equivalent form of ‘human’ time being durational. This generative artwork, co-created with plants, engages three temporal registers: the micro-temporal register of

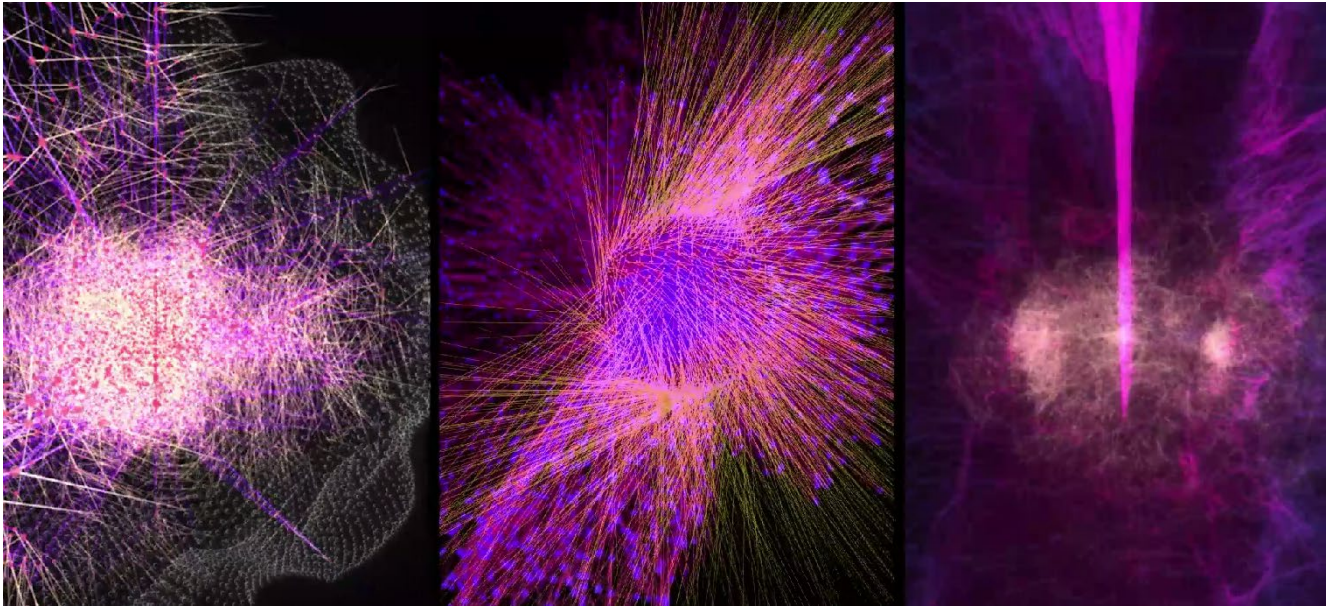


Figure 2. Screen capture from *He Koiora o te Wa: Biology of Time*
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machines, the phenological register of plants, and the durational register of the human body. In the micro-temporal register of machines, decisions by software operate outside of the threshold of human perception, yet nonetheless influence human movement and action. Since the plants involved as co-composers in this installation were operating on a phenological time scale, human participants must wait until the plants emit a signal to be sonified and visualised. This process is not regular, and depends on how the plant is processing light, water and nutrients, so it is not on demand and cannot be controlled by the human participants. In the phenological register of plants, organic matter elicits a human response via signal. Yet, while the plants are not contributing to the assemblage in the same way we would ascribe to human gesture or action they are nonetheless affecting and being affected. Across these temporalities, material phenomena (data objects, real-time animations, electrical signals and so forth) activate one another through intra-actions, where the digital materials of computational networks, tangle with the fleshy material of the body, and the slower paced agential realities of living plants.

These different registers of time might be thought as parameters or thresholds from which to apprehend a different understanding of materiality. Barad explains the relation between intra-actions and temporality: Intra-actions are temporal not in the sense that the values of particular properties change in time; rather, which property comes to matter is re(con)figured in the very making/marking of time (Barad 2007:180). Partially and contingently, matter becomes what it is because of an intra-actively enfolded relation with not only the apparatuses that materialise it, but also with time in all its variances (durational, phenological, chronological, micro-temporal, and so forth). Human intra-actions that

produce time and matter in this artwork, are recursively produced by those same forces. Differentiations between ‘which property comes to matter’ are enfolded in intra-action as a ‘making/marking of time’. Engaging with these differently materialized temporal flows means remaining open to time as a series of material encounters. While the plant signals generate the installation by itself, humans visiting the work can touch the leaves of the plants, thereby also influencing the real-time visualisations by shifting the data produced. Perhaps placing hands at the base of a leaf to shift the bio-electrical signal, or at the tip to cause a stutter, human interlocutors might become open to the potentials of the co-composed materialities that unfold, multidirectionally in spacetime. For example, the plants will not always emit sound. There signals are punctuated by pauses, which cause human participants to similarly wait. Through these relations with other orders of temporality – as well as the perceptual impact of the spatial phenomena discussed earlier – performative interfacing implicates humans, plants and data in an alternate reality that exceeds everyday human embodiment. We might call this new mode of embodiment a critical posthuman performance modality. Assemblages like *He Koiora o te Wa: Biology of Time* that afford humans the capacity to co-create with non-human kin, implicate participants in a critical posthuman performance modality that challenges human embodiment by imbricating the body in a new collaborative system based on electrical energy.

Acknowledgements

Rewa Wright would like to acknowledge the kind support of Queensland University of Technology in realising this research project.

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Author(s) Biography(ies)

Dr Rewa Wright is a media arts and computational design researcher with a collaborative and transdisciplinary practice encompassing exhibition, performance, publication, presentation, and community engagement. Rewa's work has been included in the SIGGRAPH 2023 (Los Angeles), SIGGRAPH Asia 2023 (Sydney), SIGGRAPH Asia Art Gallery 2019 (Brisbane), Ars Electronica: In Kepler's Gardens 2020 (online), the Aotearoa Digital Arts Symposium 2022, The Wrong Biennale, and 6 iterations of the International Symposium of Electronic Arts (ISEA). She is Senior Lecturer in Creative Practice (Film, Screen & Animation) at Queensland University of Technology, Australia. Working with various modes of analogue and digital art since 1998, Rewa has over 20 years of experience in various aspects of motion-based and sonic media, including live performance, music, digital design, and virtual environment creation.