Heritage Frontiers in Computational Art:
The Oceanic provenance of Permacomputing and Computational poetics

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Abstract

This paper explores how culturally distinctive minimal computational art practices open up spaces for emergent alterities that more accurately align with the innovative landscape of the Oceanic region. It argues for the necessity of future literacies, focusing on the potential of radically sustainable computing (Heikkilä 2020) and text-based forms of computational poetics (Tenen 2017) to raise awareness of context-based social, material, and ecological relations. Drawing on feminist digital heritage studies and philosophers of technology (Doruff 2006; Gibbs 2011; Cameron, 2021; Dekker, 2023), the discussion analyses post-patriarchal computer subcultures and surveys media art emerging from the southern hemisphere. It compares and contrasts (implicit or explicit) intentions for efficacy to nurture a more holistic integration of technology, art, and culture. It examines the provenance of codework poetics to demonstrate how self-determined cultural inheritance can transcend digital colonial logic. A close examination of the provenance of codework poetics demonstrates how self-determined forms of cultural inheritance can reshape and transcend the restraints of digital colonial logic. The analysis highlights the significance of informal communities of art practice that engage in experiential forms of digital literacy, which can attract a more diverse range of constituents—describing the ways in which 'Big Tech' is enmeshed in colonial imperatives, driven by the accumulation of capital and unsustainable computing emissions. It critiques the dependence on 'Big Tech' partnerships witnessed in the uptake of the digital in art museums as seamless, immersive experiences, which procure audience engagement and optimisation through glib forms of instant gratification and token exploits. The findings offer insights for navigating future heritage paradigms within computational media art, advocating for context-grounded experiential learning and reciprocal economies of digital heritage.

Keywords

heritage algorithms, Oceana, codework, future heritage, technē, digital decolonisation, sandboxing, informal cultural economies, philosophy of technology, critical media theory.

Introduction

This paper sheds light on computing arts practices that more accurately reflect the rich and complex landscape of the oceanic region, particularly through their sustained contributions to reciprocal economies. In the digital media art landscape, a notable disconnect often exists between the sites of encounter in computational environments and *in situ* contexts.

Before I elaborate, I am obliged to communicate the wider atmosphere in which many of us find ourselves: an era of ecosystem collapse, teetering on the brink of the seventh mass extinction, in the thick of grappling with the challenges posed by the fourth industrial revolution's failures, tittering on the cusp of the Fifth Industrial Revolution. [1,2,3] These pressing circumstances underscore the imperative for artists working with computational mediums to acknowledge the direct impacts of climate change. Consequently, I describe alternate computing art paradigms driven by practitioners whose sustained contributions nurture an intimate

awareness of the translocal environment in which forms the ground of such operations. Translocal is defined by artistic researcher and digital performance maven Sher Doruff as a "multifaceted.…philosophical insistence on the "trans" (across, or dynamic movement of crossing) as a preferable prefix to the "tele" (at a distance)".[4]

The complicated nature of spatial processes afforded by Internet-enabled mobile microcomputers, compels a reexamining of processes of networked art and VR/AR mixed reality (XR) employed by the Gallery, Library, Archives and Museum (GLAM) sector, many of whom increasingly narrate a stance in alignment with environmental activism.

To show us a way out of these conditions, I focus my account on a brief survey of permacomputing movements and codework as practices exemplary for heritage frontiers; incidentally, the provenance of these techniques is in Oceana. I clarify how these transdisciplinary forms spread awareness of low-carbon methods through fostering experiential learning communities and inheritance formats of documentation that better support sustainable customs and context-contingent experiences of living with digital artifacts across generations. My propositions are invigorated by artistic countercultures that float between somatic movement, citizen science fiction, heirloom computing, and repair movements to "re-imagine Internet futures".[5]

Amid a realm of computational profusion, I posit how these regenerative frontlines provide a "lever for rethinking digital cultural heritage otherwise as imbricated in planetary life".[6] Contributing to maturing discussions by feminist philosophers of technology, many familiars guide my considerations. Among these are: digital heritage scholar Fiona Cameron who notes "new forms of writing, recording, memory capture, knowledge production, and anticipatory programming, and through interactions between agencies and systems both human and non-human, an array of data forms involving more-than- and non-human intelligence and cognitive systems that arise challenge current understandings of heritage".[7] Annett Dekker digital art/performance curator and archival and information studies and cultural analysis researcher suggests "rather than merely a way to guide conservation, doing documentation is future oriented…art projects evolve, change, modify, or mutate such that they can have different manifestations over time…towards the future that is yet to be defined".[8]

Currently, the emergence of new technologies, new types of societal data and production processes are largely driven by the intensification of planetary economies. This can be witnessed through how public consumption of computational resources is exacerbated by the corporate platforms of 'Big Tech' —Facebook, Amazon, Netflix, and Google (FANGs) —user-friendly global platforms. Services designed and progressed to concentrate on the financialisation of culture. i.e., the *Ad Tech* strategies embedded in networked infrastructure. FANGs, dominant digital cultures centred around "Western Industrial Educated Rich Democracies" (WEIRD), have become so ubiquitous that they have become indiscernible to consumers using the platforms.[9] The

insistence on fixed coherences and expectations that have reduced understandings of digital culture, mistaking digital literacy as merely participating in extractive consumption of FAANGs that account for at least 50% of all global Internet traffic. Virtue signaling posturing of 'digital disrupters' glued to the social media grid through their mobile phone, maybe at best reacting to material properties of computation as fetishised forms of error beguilement. A deceptive act of tokenistic exploits unveils a sea of unforeseen complexities.[10]

The assumptions made around the adoption of computing devices technology rarely consider the limitations that people may be affected by or choose to curb. This is evidenced in the file size of digital content increasingly becoming resource intensive, which is as much of an equity issue as it is environmental. The sound of a hard drive whirling when faced with a capricious request to download content or view distended websites that assume the user has adequate system requirements and access to the bandwidth for a fast connection or an unlimited data plan to render high-end graphics and video random-access memory (VRAM) used to store the pixels and other graphics data and framebuffer renders on screen. If deficient, a wheel of death appears, and/or the user may be treated to a fragmented series of malfunctions. These insidious procedures conform to the colonial logic of capital growth and progression.

Prevailing norms of user-generated content reveal the dark flipside of contemporary real-time web and social media platforms, user expectations of immediacy and speed are underpinned by corporate digital infrastructures through which real-time data exchange enacts and captures ongoing activity, often imposing a finite set of actions of this media philosopher Robert Gehl elucidates, "the smooth interfaces that users enjoy appear to be comprised solely of immediate connections and instant information"[11]. Companion to this Big Tech ecosystem is Ad Tech, which drives corporate Internet companies such as FANGZ, which profit from the sweltering business model. "Ad Tech is a term that encompasses a wide range of technologies and strategies used to advertise digitally…reinforcing a co-dependency that silently (yet incisively) blurs the boundaries between the military and the civilian sectors…is particularly critical, posing significant threats to democratic processes by benefiting totalitarian modes of operating at a global scale".[12] Not only do these platforms facilitate advertisers targeting users with the explicit aim of shaping consumer behaviour, but their social functionalities are known to introduce interactions in physical spaces to the detriment of local ecologies. An example of this is uncovered in the southwest of lutruwita/Tasmania, where despite benevolent efforts by Tasmanian Parks and Wildlife Service to promote "Leave No Trace" principles, crowds of bushwalkers continue to cause long-term damage to delicate ecologies, potentially erasing fragile place-based cultural heritage.[13] Visitors using smart mobile devices to 'check in" on social media platforms such as Facebook, Instagram, Google Maps add location pins on digital maps of these sites. With each status update or Instagram photo, they demarcate a trade route for holidaying multitudes to exchange digital souvenirs of their experiences, spawning even more vacationers.[15]

Meanwhile "silent militarization" of Ad Tech spawns and proliferates. In June 2023, Google was charged with misconduct by the European Commission for profoundly violating antitrust laws. Cultural diversity and social practices end up unknowingly mixed in the deceptive blender of contemporary Internet culture.

Revenue-generating Ad Tech defines "assumptions around the kind of interactions possible with cultural artefacts".[16]

The Muse-Tech Working Group formed by the Irish Museums Association (IMA) in Dublin states, "Development of digital collections, exhibitions, and resources must be ingrained with the principles of cultural democracy and create opportunities for community participation". They ask, "In what ways can the public engage with the process of digitisation, not just the end result?".[17] Cultivating knowledge production and sharing beyond traditional notions of collection and purposes of capture, interaction modes user experience (UX) in XR is often designed to arrest human attention entirely. Assumed default computing requirements encoded by dominant digital ecosystems exhaust people's perceptual ability to know when to step back and read the space to the impairment of managing the human tendency to react instead of reflecting and then responding to charged situations. A notable anomaly is digital artist Andrew Burrell, who describes his efforts to redesign the artwork *Glossopticon* (2021–2022) "taking into mind the central considerations…openness, accessibility, and attention to the ethics of technology".[18]

As the computational art community navigates the next quarter of the Twenty First Century, we arrive at an advantageous moment that presents a chance to recircuit extractive economies. Before I dive further into specifics, the critical on-the-ground complexities, of which there are many, must be acknowledged. First and foremost, "growth in computing emissions is unsustainable…almost 4% of the world total".[19] On the one hand, digital products are built by software engineers in response to market demand for profit, to a mandate typically aligns with the laws and exponential trajectories of computing resource consumption.

On the other hand, there are harsh facts about the asymmetry of mobile devices' short lifecycle and hefty market demand. Frugal computing connoisseur Wim Vanderbauwhede explains, "Emissions from production…exceed the emissions from operating them, so even if devices are more energy efficient". Producing more of them exacerbates this problem, "Therefore, we must extend the useful life of our computing devices. As a society, we need to start treating computational resources as finite and precious, to be utilised only when necessary, and as effectively as possible."[19]

Undeniably, transformation is difficult to perceive when altruistic arbiters attempt to address the climate crisis with environmentally aware content, deploying computing resource-intensive Ultra-HD video and VR/AR bankrolled by 'Big Tech'. This epitome is revealed in the artwork Venture into the Wild, a collaboration between ArtScience Museum Singapore, Google, Lenovo and the World Wildlife Foundation (WWF), an immersive XR video landscape commissioned as an ongoing permanent installation in 2015. "For every virtual tree planted, and accompanied with a pledge to WWF, a real tree will be planted in a rainforest in Indonesia".[20] The large-scale magnitude of immersive XR environments that roll out increases 3D video traffic and blissfully disregards the fact system energy consumption assumes eradication. While it is noble to encourage the audience to partake in actional recognition of vanishing habitats as a consequence of palm oil deforestation and climate emergency, as a visitor, I was unaware of how my positive digital gesture interconnected with other beings and genuinely impacted the remote location beyond the exhibition. And if I was merely a consumer, my experience

was rendered to that of a perfunctory novelty, contravening the vision of Tim Berners-Lee for a decentralised World Wide Web (WWW) who "designed it for a social effect—to help people work together—and not as a technical toy to support and improve our weblike existence in the world…".[21]

Evaluating some of these perils, Birch & Bronson discuss the polemics of how "digital ecosystems enable Big Tech to make economic rents in new ways that reinforce their techno-economic power while undermining the political, social, and economic capacity of others to shape the future", asserting GLAMs who influence dominant paradigms of digital heritage must engage with the "heterogeneous assemblage of technical devices and platforms, as well as users and developers, legal contracts and rights, collective standards, etc."[22].

Berners-Lee recaps, "For people who want to make sure the Web serves humanity, we have to concern ourselves with what people are building on *top* of it".[23] The late philosopher of technology Fredrich Kittler articulated how "on an intentionally superficial level…graphic user interfaces, since they dispense with writing itself, hide a whole machine from its users". [24] This acumen twigs when we read a colleague's email containing a footer that requests their recipient *save the trees, but don't print this.* The moral posture literally communicates a disregard for context-dependent processes with which the sender interacts — the networked infrastructure, the written content, the carbon footprint, the server storage space — the email data will continue to occupy. This custom signature perpetuates the misleading binary of digital as immateriality that only reinforces systemic issues around consumption that detach computer technology from the ecology it impacts amid a vast translocal environment.

Reorienting from grievances with trite customs where people fail to grasp their material context to acknowledge that "the very idea of climate change is …an epistemological accomplishment of planetary computation"[25], towards expanded forms of computational art tailored to environments and situations that kindle perceptual sensibilities. Anna Gibbs observes how the codework of Australian artist and writer Mary Anne Breeze (aka Mez) "highlight the complexities both of agency and address that print-based technologies allow us to overlook".[26]

I will now enter into the seldomly contemplated prospect of informal practices of computational poetic communities as self-determined cultural manifestations.

The agencies of computational Poetics and Permacomputing

The public frontiers of experiential computational art communities are dynamically distributed beyond official systems of global art market establishments and countenanced in various forms of arbitrary personal storage (computer hard drives, mobile devices), informal writing on the Internet (through messaging, status updates, emails, mail lists) and code repositories.

A growing body of computing arts practitioners are committed to the purist of algorithmic self-sufficiency in distinctive forms of holistic computing practices that embrace polyvocal expressions, spectral political values, translocal regenerations, codesigned web servers, non-metro poetic language integration, and underclass currencies of intimate exchange that arbitrate the logics of obsolescence and digital colonisation imposed by WEIRD FAANGs and related necrocapitalist entities.

To briefly contextualise for the uninitiated reader, these philosophies align with some of the radical invocations of Dada,

Situationists, Black Panther Party for Self Defense, Fluxus, Beats, Pirate Radio, D.I.Y. punk movements whose ceremonies, artefacts and actions propelled social engagement through a variety of communication means beyond the confines of state-sanctioned GLAM. In these sites of density, we can find the artefacts of codework, the tendrils of which can also be traced to translocal practices of mail art, concrete poetry and/or visual poetry actions of writing, processing and design, which often extrapolates graphitic algorithmics and dimensional materialities of spatial kerning composition.[]

Entering the world stage from the left wing in the 1990s appears codework, a profound eclectic art form that draws heavily from computer subculture text chat—the playful coded geek elite language, known as leetspeek (*1337*), or, l33t. Eclectic instances of words in an alphabetical language are translated through component symbols i.e., L= 7 or C= 3 | e = 3. A lingo that breaks down and morphs, i.e., dude = dood = d00d, leveraging from the fluidity of text-based communication errors and typo aesthetic of informal *on-the-fly* register, standard letters are piped through a cypher that interchanges numerals or special characters resembling alphabet symbols. For instance, during an Internet Relay Chat (IRC) in the computer shell, one may encounter an 'initiated' geek performing their sp33k (speak) and subcultural prowess in slang. Often these d00dz add to convivial sociality online, emergent chatting *in situ.*

In 2001, Alan Sondheim offered a botanic definition of codework; "Using the metaphor of a tree, codework can be placed within a very rough taxonomy… a. with reference to computer language and engagement…playfully utilize programming terminology and syntax…Examples include multi-media and hypertextual works—they're the leaves and bouquet of the tree, the efflorescence. b. Works in which submerged code has modified the surface language… for continuous surface deformations. They're the tendrils and branchings of the tree, half surface and half root….it's the result of a group of processes and catalysts… c. Works in which the submerged code is emergent content; are both a deconstruction of the surface and of the dichotomy between the surface and the depth…These works are the rhizomatic roots of the tree…In order to understand what's going on, it helps to look at source code (which can be part of the content)."[26]

For instance, technical documentation of code often includes annotated responses in the source code comments (see Figure 1); assemblages enable potential readers and writers of culture to move beyond the mere procedural formalisation that operates at several layers, weaving an interlocking fabric of language with higher-level human-readable codes and lower machine-readable characters.

Figure 2. Screenshot of the source code of the .html webpage of a callout for the Master Experimental Publishing, Piet Zwart Institute Rotterdam, an exceptional two-year course that alumni and related others fondly call a 'master ofhacking'. Image: Nancy Mauro-Flude

As I have established, codewords are typically a paratextual synthesis of plain text programming, idioms of natural language —a syntactical interplay of vernacular dialect, computing subculture and social engagement. The way codework lends itself to tacit knowledge and tactical linguistic tenacities of satirical forms through syntactic substitution (enallage) in which one grammatical symbol is replaced by another, i.e., (\$ replacing S) is often witnessed in pop culture.

Intentional malapropism (misspelling) is a political tactic that resists the norms of establishment and questions conventional standards of imperialistic erudition, an implied form of insidious control that oppresses individuals who are unable to perform the dominant order edicts—specifically, marginalising people who may not be privileged to have been educated and versed in orthodox grammar rules, or, those who are otherwise unable to perform, and/or chose not to play into the hands of gatekeeping tyranny.

Sustained forensic acts of non-discriminatory circuitry and divergent spelling are located in the codework oeuvre of Mez, whose Mezangelle is a distinctive language that reverse engineers the relics of imperialist infrastructure imposts—subtly rewriting the targeted and plagued approaches of supremacy's persistent customs. The ways this computational art form acts in harmony with the innovative landscape of the Southern Oceania archipelago will be resumed in the next section of this essay.

Let me set the scene for how codework practices intersect with text-based forms of computational poetics and "radically sustainable" critically conscious computing practices of "permacomputing". A 21st Century derivative of the Permaculture design method and geographically dispersed counterculture that took seed in Lutruwita/Tasmania (devised by Bill Mollison and David Holmgren in the mid-1970s) moving away from segregated industrial farming towards integrating the ecosystem in which people live amongst paying attention to reciprocal flora and fauna elements. Led by the design values: "Care of the Earth: Provision for all life systems to continue and multiply; Care of people: Provision for people to access those resources necessary for their existence, setting limits…[to]consumption. By governing our own needs".[19] These design principles are modelled by minimal computing practices of permacomputing, that emerge from specific ecologically informed countercultural contexts of open culture and peer production, a motley crew compelled by a shared commitment to exploring alterities to FAANGs—the intricate and anarchic processes of relations formed through spaces of learning.

These potentials were initially described in 2010 in "Design Patterns between Free Software and Permaculture" by Jaromil.[30] Permacomputing is a holistic approach to visceral systems that seeks to raise awareness and share advice against planned obsolescence, intervening in the growth logic that drives computation.

Mapping the emergence of permacomputing empowers future constituents to learn about genealogies; it is critical to create entry points for diverse voices of communities at the global margins that otherwise become fragmented, lost, and invisible if not included.[i] Context-based knowledge sharing in permutational cultures never arises from one discrete moment of genesis. Marloes de Valk "searches for the origin and first uses of the terms permacomputing and small tech" creative technologist Ville-Matias Heikkilä, aka Viznut, as the originator of permacomputing in 2020", in "A pluriverse of local worlds: a review of Computing within Limits related terminology and practices", she traces the provenance to "the demoscene, known for squeezing the most out of very restricted computing resources, such as the 4k intro with a maximum executable file size of 4096 bytes".[31]

I unearthed similar tactics in the 2012 book Code {poems}, contributions in any coding language that needed to abide by two rules: 1) 0,5 KB maximum size as a .txt file; 2) Required to compile, this publication features a series of works by computational arts researchers including Nancy Mauro-Flude (myself) and Aymeric Mansoux whose art practices intervene in the growth logic that drives computation to raise awareness against planned obsolescence. [32] Similar relations between codework literacy, computing arts and permaculture that "adds new dimensions to existing narratives…emphasises the value of the personal…as a process…characteristic of incompleteness and ambiguity create an opening to a reconciliation with uncertain pasts and futures." can be traced back to 2011 and 2005. [33, 34]

The methods of re-use of unwanted surplus in permacomputing emphasise how systems, media and materials are finite sources that often need repair or regular maintenance, i.e., understanding the Internet as a series of file tree directories containing a series of text files containing mainly executable code. For instance, the size of digital objects and consideration for the necessity of large amounts of content that require powerful computer processors to transmit, access, and render. Its proponents seek to occupy data centres committed to renewable energy sources to address the growing reliance on Internet consumption and "Create low-power systems that strengthens the biosphere and use the wide-area network sparingly. Minimize the use of artificial energy, fossil fuels and mineral resources. Don't create systems that obfuscate waste."[35]

Permacomputing is gaining currency as the world leaps into a phase of species collapse and simultaneously speeds into yet another industrial automation consumption.[1,2,3] On *lines* an open and collective community forum supporting civil discussion, at the time of writing, there were meta category 156 signups in the last 30 days and 2.500 active users, which have tripled since the new topic in the meta category was opened for permacomputing in June 2023.[36] A place of commons to inform interested constituents, featuring topics and advice on situations someone is confronted with, for instance, if someone does not have funds to pursue repairs of a meticulously designed and exceptionally expensive broken Operating System. These forums seek to build confidence so that people can indefinitely steward the many obstacles of repairing gadgets many of us depend on, which require a massive knowledge in the arrangement of material and informational streams from which there may be no practical escape. This exists alongside a website wiki dedicated to permacomputing, which contains a broad field of related information and explanatory instructions dedicated to suggestions on where to get started, demonstrating the diverse politics embedded in radical modes of organisation and production.[37] Minimal computing practices privilege low-fidelity text-based command-line computing over bloated proprietary software. For instance, video editing tools (such as #ffmpg) are preferred over expensive CPU-intensive software (like Adobe Premiere). There is a steep learning curve at the frontiers of computer culture, and installing codes and drivers for hardware operation is sometimes brash and unforgiving. This permacoputing wiki caretaker

earnestly makes lists to evaluate environmentally responsible computing practices. From an infrastructural perspective, repair cafés and salvage gatherings are used to share components and methods of raising awareness, i.e., the 'Small File Media Festival' addresses the issues of the carbon footprint of streaming [38].

Digital inclusion and information that include nonstandard literacies–are needed, first and foremost, to understand expectations and energies around the necessities for cross-cultural exchange that drive low-carbon computing practices as reciprocal ecosystems. This demonstrates how environmental footprint is just one of the barriers to citizens' access to autonomous, sustainable computational art. These catalysts differ from hackerspace enclaves such as the *'people doing strange things with electricity*' franchise initiated in the northern hemisphere; Dorkbot Sydney thrived briefly around 2010. Its convivial yet potentially exclusionary atmosphere of privileged art students absorbed in digital experimentation was fleeting, as evidenced by the limited tenure of its caretakers and the absence of sustained documentation to nurture future generations of engagement. The legacy of these efforts persists only in a handful of documented photographs, serving as but one illustration among many similar cases in Australia. [39]

In contrast, the frontiers of experiential computing art practices unique to the southern hemisphere are seeded by a loose cohort of digital caretakers with a combined background in grassroots activism. Practitioners participate in experimental publishing and expand notions of machinic agency to express intermediary relations through performances that embrace the remedial properties of components, devices, bodies, agents, and energies of visceral systems, including the right to repair. Exposing technology's inner workings, transferable connections are made through the expression of code in otherwise hidden procedures, which enables practitioners to caretake the environments within which they work more adequately. [40]

The specificity of context-dependent processes promotes a hands-on understanding of constructive, temporal, and embodied labour in the writing and reading code literacies. Workshops and projects deploy file tree metaphors as building blocks to spatially comprehend a series of paths we navigate in a computer system; a trusted metaphor for both software modelling and decision-making provokes broader practices of digital culture as a "dynamic ecological composition in duration" which critically deepen participants understanding of computation as a cultural practice. [41] Situating the analysis in the sociotechnical relations of digital art contexts is captured in the *Weaver Birds* document by dyne.org network, released on the eighth year to celebrate: "patterns that modularise sharing" of Free software propagation "in horizontal, nonhierarchical ways…methods, knowledge and tools, keeping them out of any box…developing auto-didactic literatures". Written the 8.8.8 whilst camping amid the Merapi volcanos in Yogyakarta, Indonesia, amid the vibrant exchanges during translocal convergences on the island of Java. This declaration claims to deliver "spiral architectures of living swirling above our heads and across our fingers, as they evolve in a common practice…re-conjunction, joining the loose ends of our future"…"linked with education models that foster tolerance…and "grant protection to the minorities' acknowledging these "dreams, as they slowly but steadily are becoming reality."[42] Soon after, a feminist-led web server and digital literacy atelier was a homebrewed garage in the southern part of lutruwita/Tasmania, touted as a "technological

coven disguised as an art project"[43]. Spirited knowledge sharing and digital caretaking are kindred with *The Collapsible Project* based in aotearoa/New Zealand, formed in 2023 "The goal of this project is to gather strategies, skills, disciplines, technologies, ideas, designs and critical thought in an effort to help prepare communities big and small for a time of great upheaval…".[45]

The inception of the Feral MbA Pilot on March 1, 2020, in Hobart (lutruwita/Tasmania), "a radically different kind of training course in business for artists and others. Its mission: to delve into the…protected realms of 'business' and 'economy' with a wild curriculum of ideas, practices, resources, radmin and experiments"[46] is another instance of alliances are found in the conjunctions act in solidarity in knowledge sharing with a diverse array of beings, data fauna and flora fiction across the archipelagos of Oceania. These are some ways historical knowledge can affect how computational artists conceive of heritage futures in an endeavour to open out the confinement of Northern Hemisphere (Eurocentric) computing arts disciplines upon the received genres of computing arts that critique greenwashing tactics increasingly deployed by capitalist regimes.

Digital literacy conversation circles, shell spirals and strings
Emergent forms of radical computing arts represent future literacies that promote digital inclusion through their dynamic nature. However, it is essential to acknowledge the challenges we face and understand how global forms of digital colonisation endanger both human and nonhuman entities. Therefore, acquiring digital literacy involves experiential learning and pedagogical frameworks that focus on the operational capacities of living organisms. Spivak highlights the importance of prioritising literary detail and engaging in close readings, contrasting with the contemporary emphasis on WEIRD FAANGs, which often oppress numerous informal cultural economies and underserved communities worldwide "(para)logcal" morpho-genetic (giving rise to new ways of reading, writing, teaching in the strongest sense), without terminal teleological innovation… the remaking of history is a persistent critique, unglamorously chipping away at the binary oppositions and continuities that emerge continuously in the supposed account of the real".[47]

Demonstrating respectful cooperation with Indigenous knowledge systems can lead to broader shifts in digital heritage practice that reconnect communities with digital cultural inheritance and unsettle power structures embedded in computation and colonial cultural heritage paradigms. I will closely read a specific section of codework that weaves in heritage patterns of shell stringing processes.

To thread the needle suitably, first, the reader must be acquainted with activating pathways for hands-on human involvement in text-based algorithms and intricate procedures in the 'shell' of the computer terminal, an environment used to operate live code in strings of symbols to get various output results. A series of interrelated programs are not self-contained or static; other processing that may run simultaneously are often connected remotely to other computer ecosystems.

An initial outline of the processes of commandline computing that take place in the computer terminal's shell enables a user to create plain text files and directories straight from the command line that can illuminate, among other things, processes that seethe

with activity under the surface of the computer's interface. Human-constructed algorithms are scripts for simple rule-based tasks to compute and process data streams. In the shell, one can search for a file for lines containing a match to the given strings, words or lines of text that match one or many regular expressions and outputs only the matching lines. For example,
`([a-zA-Z0-9])\\1{6}([a-zA-Z0-9])\\2`.
This regex will match any string with seven of the same character followed by one different character. it will match `"aaaaaaa1"`, `"1111111a"`, `"BBBBBBB2"`, etc. but not `"aaaaaaab"` or `"11111111"`.

The intrinsic hands-on activities and the specific ordering grammars of action communicate in a site of encounters, we gain insight into how data flows focus on how the activity in heritage patterns of algorithmic capture may be written in the extractive 'Ad Tech' scripts that monitor personal mobile digital devices these codes seethe underneath the imposed proprietary protocols of commercially led hardware and software production layers. Stringing the sequential execution of commandline programs embodies strategic and purposeful processes. These codes can be shared, modified, and extended, and they exist as organisms in flux—heritage patterns in both mundane and procedural spheres. When taken out of the commandline shell environment and into 'the wild' of a text editor, the conditions of the codework components and delineated boundaries for executable operations are altered.

The markings of the keystrokes that type out characters, numeric symbols, and alphabet symbols are modular in form yet informed by an assortment of actors, dynamics, and practices. The operational capacities may be interpreted and/or advised through social arrangements, cultural methods, and politics that digital technologies incorporate and enable. This may depend on the text editor used and what operating system (OS) allows what type of textual program. For instance, if an aspiring codework poet is using a copy of Microsoft Word owned by a university, it is likely the blank page will already have a yellow marking embedded into the header of the document, amongst other security settings, permissions and modalities of use patterns set and baked into an ostensible blank page that is a long shot away from so-called neutral space. Too often, "Technophilic" practitioners exhibit heroic utopian motives in declarations of resistance, "vibrant in its manifest circulation of the globe in the form of default 'universal' values espoused by hegemonic nations and economies".[48]

These considerations must be considered before the code poet starts to write. Depending on the settings and computing environment indicated by the poet/user, on the advent of typing, the OS may anticipate formalised spelling according to gramma standards and a continual reminder that while they may have wanted to proceed unhindered, their work is conducted in collaboration with a set of nonhuman agents at hand lurking in off-screen, as such in the darkness off stage. In addition, a series of other software processes may monitor the user's keystrokes, such as the cloud-based typing assistant *Grammarly, which* will continue to give recommendations until it is turned off.

These processes are watching, advising, monitoring use patterns, acting and anticipating interaction and behaviour before the codework poesis begins. The delicate taxonomies and intrinsic "grammars of action" in codework inferences facilitate us to elaborate upon acts such as the tangible performances of hands-on activities in text-based computing.

And while codework acts just as software exists, a medium of language makes it available for anyone to phrase, choreograph and compose. The poet must be aware of these constraints to set up the most feasible environment for composition. Even with a grasp on literacy, however, expanded or constrained. Exceedingly open to idiosyncratic configurations, permacomputing and codework are related to a history of metaphysical practices in algorithmic cultures such as language combinatorics, word permutation poetry, aleatoric composition, recursive text constraints reminding us that every action we take, in whatever orbit, can transform heritage practices into a reciprocal economy of shared relational processes, carrying layers of meaning and connect us to intangible forms of future heritage. We can better explore how codework presents opportunities to intervene into dominant paradigms of digital heritage. Pronto.

Morphing stringing methods and computational poetics

The following codework analysis takes an extract from Mez Breeze's *Human Readable Messages* (2011) (see *Figure 1)*. To delve into how codework assists in unpicking the problematic notion of sustainability within network topologies to generate new horizons for digital heritage frontiers.

The chapter subtitle `3.4.1` indicates distinctive vernaculars that transpire from technical versioning systems of archiving code artefacts and ending with an increment in the register of a code string of a human-readable date time stamp `_(2005-04-01 05:13.`
Dense list formations that form shells of meaning to unravel conditional and reiterated in nested sequences. The subtitle characters arranged in bold and plain text add to the granular choreography of ledger stacks. The gist of how `[s eye]` forms the leading sentence central predicate provides a clue and a motif.

```
3.4.1 pin.point.data.crow[s eye]ing_  (2005-04-01 05:13)

slush.p[acket]uppied.+watching.golden.crow.eye .morphings.

stagger.flite+anxiety.information.stringing.thru.a
ndrenals+butter.cusp.back

-ebony.swagger.fixtures+audio.[w(h)ip.e]crac
kling.+.dragging.my.VOIPer.feat
```

Figure 2. Screenshot of Section 3.4.1, *Human Readable Mezsages*_[MEZANGELLE 2003-2011] by Mez Breeze ©Mez Breeze.[49]

Syntactical compositions of codework strings interspersed with conjugated truncations codex syntaxes composed into sequences in her intricate literacies of codework in the various ways Mez articulates and refers to the visceral elements of seashell making, the careful hands-on methods of perforating seashells to thread string `pin.point.data.crow[s eye]ing`

Ventures me to surmise the codework of Mez draws inspiration from the custom of lutruwita/Tasmania shell stringer custodian Elder Aunty Lola Greeno, "Using needles and thread enables makers to use smaller shells such as rice shells, which are now frequently used as the base of a pattern"—educe sequences of evolving heritage patterns.[50]

`pin.point` induces further alliance with careful hands-on methods reminiscent in the seashell sorting process depicted by Elder Aunty Corrie Fullard,

"Putting holes in them to thread them is not hard but you've got to be careful. i suppose there's a bit of a knack to how much pressure you put on them or otherwise you shatter them. i look at them before i put a hole in them, so that when i'm finished they'll all be sorted into groups of much the same size…The steel's really hard. you put the hole in the rice shells (tiny oval shells) as you thread with the needle. Sometimes there are hundreds on one necklace".[51]

Mez notes the fiscal imbalance of informal trade economies and those with slush fund privileges, who ratify a passive, consumerist pre-packaged off-the-shelf yuppie lifestyle: `slush.p[acket]uppied.`

Returning to evoke hands-on encounters of attentive poetics referencing oceanic and avian fauna, positioning the poet-coder as a witness to a custom that adapts and changes over time `+watching.golden.crow.eye .morphings.`

The description of `morphing` recounted by Greeno, "While necklace makers had traditionally employed fibres such as twined plants, bark or kangaroo sinew and punctured shells using eyetooth of wallaby, until 1802 the smaller string width of cotton thread allowed use of greater varieties of shell in increasingly smaller sizes…" in 1830s shells were pierced using a metal awl".[52] Such 'new' equipment increased the quantity of necklaces being made and facilitated experimentation and personalisation of shell work. Market demand gives an insight into the extractive legacies of colonialism and the distinction between tools and the intimacy of preparation required in relations and scale of material ecosystems of artefacts.

common names	variations of name	Latin classification
black crows	black nerite	Nerita atramentosa
brown gulls	Checked australwink	Littorina praetermissa

Table 1. This is a brief snapshot into a non-exhaustive complication Taxonomy of Tasmanian Names for Seashell. ©Lola Greeno.[53]

The vernacular naming classification of seashells, "aboriginal women prefer to use the common names for the shells in their necklaces…there may be slight variations between names used by different families and the Latin classifications" (see **Table 1**).

The stringing tool is ever present in `pin.point.data.crow.eye` hovering to pierce and prepare, indicates Mez's tacit knack for drawing upon deep-seated embodied knowledge in codework to reflect procedures required in seashell stringing customs. `audio.[w(h)ip.e]crac kling` resonates and entwines with abbreviations of sophisticated oral cultures and distressed oppressive hierarchical subordination echoed in the colonial tradition of authoritarian `whip-cracking crow.eye ebony.swagger data.crow` contain traces of extracts of shell derivatives are distributed in the subtitle and body of the gambits into taxonomies and analogous living species: `a ndrenals` plausibly refer to patterns readily understood in the physiological processes and posttraumatic stress replaying in the autonomous nervous system of which the adrenals are linked.

A point of similarity is constructed to the permacomputing countercultures of care to the visceral seashell practices enhanced with the following line `stagger.flite+anxiety.infor-mation.stringing.thru.a ndrenals+but-ter.cusp.back`

The haiku-style prose analysing *nix based tools, CUSP is an abbreviation for a Commonly Used System Program. Also, it alludes to the point of transition that executes between two computational states and presages that being in `+butter.cusp.back`

Notwithstanding the affable riff on lingo 'butter cup' of informal affection. Truncations voice-activated intellectual protocol `conundrums +.dragging.my.VOIPer.feat`

Codework poetic assemblages operate at several layers, weaving an interlocking fabric of high, human-readable codes and lower machine-readable characters. Thinking along the curvatures of a matrix, the sequences of codework poesis are choreography of visceral compositions devised from algorithmic rituals. Where the kerning transpires in the cells, the blank spaces, the interstices between the letters and/or markings.

The breakdowns of strings of cyphers merge the artistry of seashell threading as something more that goes beyond mere threading and collecting to a vast, attentive, profound form of awareness, a co-productive understanding of the social lives "passed on as a dynamic ecological composition in duration – that is, as societal data worth continuing".[54]

Mez is a polyglot; her potent ability to speak the languages of many levels and her fortitude to crusade as a translocal actor over three decades without such a figure, the edges and edifices of computing arts culture would crumble.

Conclusion

This pursuit seeds the ground for compelling computational art awash in Oceanic specificity. These analytic discoveries transport us in the way they actively enable the heritage future of potential readers and writers of culture to move beyond mere procedural formalisation.

The transformative potential of context-based computational poetics navigates through entities and matrices, revealing tacit ecosystems of future literacies and broadening our understanding of knowledge systems beyond normative standards.

We can find remedies in attentive integration of daily digital communication into heritage practices that steer away from platforms that erase cultural specificity in computing arts practices that provide alternatives to FANGs and shine a light into more reciprocal forms so that digital cultural heritage can flourish. The computational art practices I refer to offer no silver bullet solution or promise of deliverance. Pointing out complexities has the profound capacity to provoke discernment in our audience, opening thoughts, feelings and experiences to a quantum array of possibilities, reshaping our relationship with digital consumption, fostering accountabilities within translocal ecosystems, reflecting the ethos of place-based culture within transdisciplinary computational art communities.

The significance of experiential forms of radically sustainable computational practices, poetic anchor, and harbours of ambiguity transcending temporal boundaries. As we delve deeper into common parlances, we uncover deeper veracities and inheritances rich in data fauna and flora fiction. Intricate exploration and documentation of codework's readerly/writerly histories give rise to new artifacts and co-creations of holistic future literacies.

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Dr Nancy Mauro-Flude is a digital caretaker, a proud generational Tasmanian and founder of the School for AC/DC+P). Drawing from her training in theatre anthropology, dance, and somatic movement, Nancy's research underscores the significance of sharing diverse relations and literacies and

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emphasises the value of errant encounters with living systems in the epoch of automation. Her recent publications, include 'The Thorny Conversation of Art and Economy' (2023, Intellect Chicago) and 'Computabilities Dancing' (2023, Leonardo MIT) which reflect this collaborative approach. Nancy is an elected core member of Digital Ethnography Research Centre and lectures at College for Design and Social Context, RMIT.

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[i] It should be noted many of the procedures of permaculture originated through sophisticated Indigenous knowledge systems and livelihood. The ways in which permaculture systemized these is an important discussion of that exceeds the bounds of this particular paper.