



Material Deconstructions of Time: Posthumanist Interventions Through Media Art

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The topic of time and how it can be unpacked, deconstructed and designed with is fundamental to HCI, but it is also extensively engaged within artistic practice. By analysing a selection of ten media artworks, all in different ways concerned with time and temporality, we explore how artists approach these matters as culturally and politically loaded. The selected projects align with the ongoing scholarly interest in alternatives to common perceptions on time, unmaking the normative clock time and the posthuman discourse. Following an analysis of the theoretical and material expressions of these artworks, we conceptualised four themes through which unmaking was represented: *dissecting temporality*, *the unmaking of the singular*, *unmaking as messing up* and *unmaking the other*. We close with a discussion on how these themes intersect with the current discourse on unmaking in HCI and reflect on challenges and opportunities for design and theory.

CCS Concepts: • Human-centered computing → Interaction design; Interaction design theory, concepts and paradigms;

Additional Key Words and Phrases: critical analysis, unmaking, time, media art, posthumanism

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1 Introduction

Within **human-computer interaction (HCI)**, time is an implicit component of how interaction is experienced and materially played out [Wiberg and Stolterman, 2021], as well as how it is continuously reconfigured, unmade and abandoned. Vallgårda [2014] highlighted temporal form as one of three key dimensions of interaction design. Similarly, Fuchsberger et al. [2015] presented seven sensitivities that address the effect of time in interaction design. As stated by Odom et al. [2022], “[*t*ime is the medium through which an interactive dialog between a human and computer begins, unfolds, and resolves”. Time is also a defining component in today’s digitally mediated societies. These societies are immediate and quick, with multiple changes occurring that we become accustomed to or resist, which is currently determined by the transition on social media from displaying chronological content towards displaying content sorted by personalised algorithms.

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Temporality is further amplified by technologies that demand always-on, always-connected and always-available living.

Nonetheless, time within HCI has exhibited a shift from a focus on clock time, which is knotted with the time of the machine, to investigating dimensions of time as an existential concern, as socially constructed and as a cultural phenomenon [Rapp et al., 2022]. We have also seen recent developments that involve investigating time as a *multifaceted phenomenon* [Rapp et al., 2022], entangled within interactions between human and nonhuman timescales, i.e., cultural, technological and interpersonal timescales on the one hand, and astronomical, geological and environmental scales on the other [Ciobanu and Juhlin, 2022; Ikeya and Barati, 2023; Lee et al., 2019]. These works may be regarded as posthumanist interventions, as they cultivate an understanding of time and, by association, an understanding of the world from a heterogeneous and plural perspective. Moving from focusing on efficiency and progress to understanding time as collective, entangled and more-than-human is also a question that concerns sustainability. Temporality and our impact on, e.g., future generations, is fundamental in aspects related to the environmental crisis, which is a major concern within **sustainable HCI (SHCI)** [Hansson et al., 2021]. Time is also central in shifting the question of sustainability from one of compromise and “*personal morality*” [Dourish, 2010] to “*asking what regenerative and respectful co-living looks like*” [Light, 2022]. Within this area, *nonanthropocentric HCI* works to unpack further the complex entanglements that form between species [Liu, 2020]. In this paper, we regard the above concerns as fundamentally engaging with a culture in the process of unmaking conventional notions of how time is represented and understood.

The role of unmaking is not only seen in conceptions of time but is also diversely present in sustainable design agendas that are often theoretically grounded in feminist new materialism [Barad, 2007; Hayles, 1999]. The discourse on unmaking is also central to what is sometimes called *multispecies justice* [Celermajer et al., 2021], e.g., in *unmasking* anthropocentric narratives that apply practices based on oversight, such as in de-extinction experiments [Ibbotson, 2017]. Nevertheless, considered creative processes as of recently, processes of breakdown allow for other things to “*add value, character, function, aesthetics, and sustainability into design*” [Liu et al., 2019]. Design researchers have engaged with unmaking in various ways [Lindström and Ståhl, 2020; Sabie et al., 2022a, b; Song and Paulos, 2021; Tonkinwise, 2013], further proposing concepts such as un-crafting [Murer et al., 2015], unfabricating [Wu and Devendorf, 2020], design away [Tonkinwise, 2013], forgetting as unknowing in data work practices [Muller and Strohmayer, 2022], unravelling and mending as embodied thinking practices constructed by care [Pérez-Bustos, 2017], undesigning [Pierce, 2012] and unmaking as emancipation for social justice issues [Sabie et al., 2023]. As it lacks a normative definition, we follow Sabie et al.’s [2023] understanding of unmaking as “*modes of thinking, articulation, and action that take on an issue primarily by taking away, taking apart, and/or taking down (including to the point of intelligibility) what currently exists*”.

Factoring the role of unmaking into the entanglements between environmental disruptions, time and HCI and considering how HCI has fairly recently begun to investigate posthumanist perspectives on time [Ciobanu and Juhlin, 2022; Ikeya and Barati, 2023; Bell et al., 2024], we turn to works in new media art for our investigation. Artists have progressively engaged with the interdisciplinary field of feminist new materialism [Mondloch, 2018a] and employ a variety of creative approaches that can address challenges of posthuman and temporal natures. We thus take as a case study a selection of ten artistic projects that vary in terms of scale and representation (see Figure 1) and were conducted by different artists or collectives. We explore these artworks with unmaking as the analytical framework to unpack the theoretical underpinnings and intellectual concerns they engage with through their material manifestations. Through this work, we make the following contributions to calls within HCI concerning unmaking and posthumanist outlooks on time. First, to conceptualise what we interpret as material attempts at deconstructing human-centred

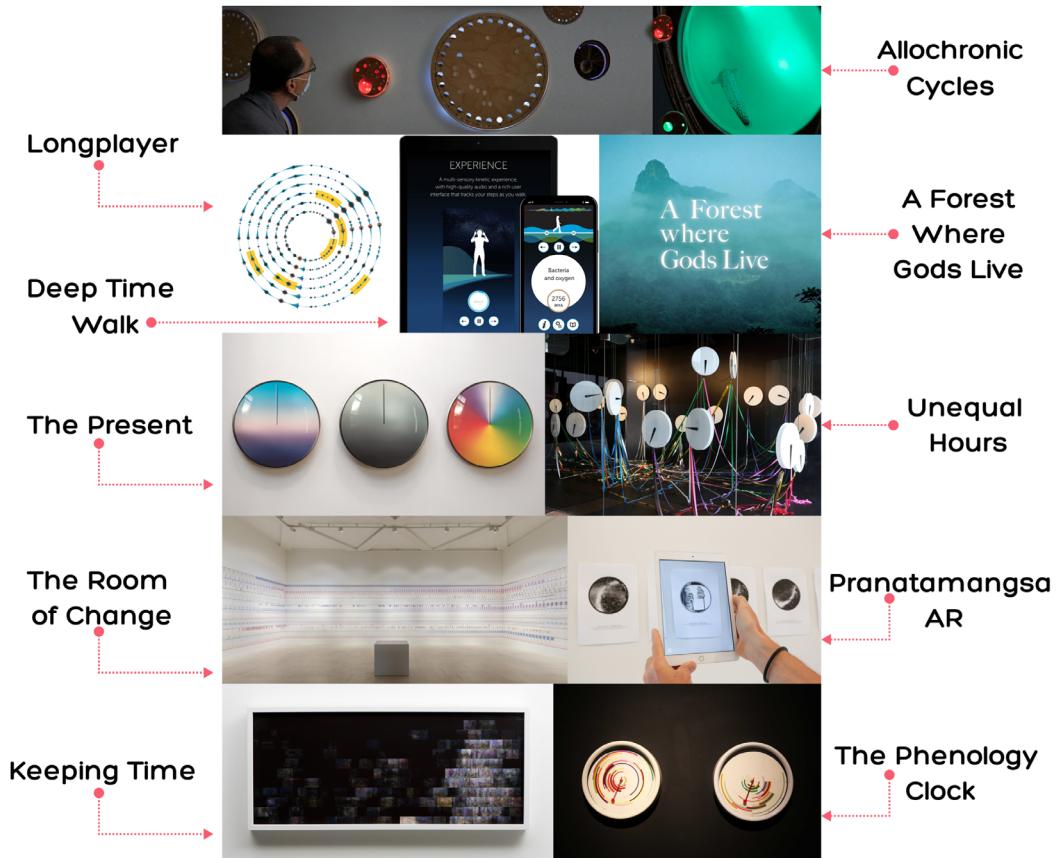


Fig. 1. Media art projects that explore more-than-human ideas of time: *Allochronic Cycles* ©Cesar & Lois [Cesar and Lois, 2021], *Longplayer* ©Jem Finer [Finer, 1999], *Deep Time Walk* ©Deep Time Walk CIC [Deep Time Walk C.I.C, 2017b], *A Forest Where Gods Live*, screenshot used with permission ©teamLab [teamLab, 2019a], *The Present* ©The Present [The Present, 2024], *Unequal Hours* ©Anna Madeleine Raupach [Raupach, 2021], *The Room of Change* ©Triennale Milano - photo Gianluca Di Iorio [Lupi, 2019], *Pranatamangsa AR* ©Anna Madeleine Raupach [Raupach, 2018b], *Keeping Time* ©Tega Brain [Brain, 2013], *The Phenology Clock* ©Tega Brain [Brain, 2011].

notions of time, we start by surveying the potential of investigating artistic practice from within HCI research. Second, we present an exploration of the knowledge produced by the ten selected artworks, unpacking these in terms of unmaking through four distinct themes. The works present a deconstruction of established notions of time, making space for new worldviews and emphasising entanglements and ways of cultivating relations. In this article, we use the notion of *material deconstructions* to relay how the conceptual deconstruction of time can be physically expressed. We understand deconstruction as the “*taking apart of what has been made—disassembling assemblages, unbuilding constructions, and dissecting structures*” [Sjoberg, 2024]. Through deconstruction, we consciously investigate the parts that form a whole without taking anything away, though some parts might get broken during the process. Namely, while deconstructing the conventional idea of human clock time, the artworks still include this temporal form among its other temporalities, thus keeping this aspect of time rather than removing it. While unmaking and deconstruction are synonymous and can be similarly understood, both standing as opposites to making and

constructing, respectively, we acknowledge that subtle differences exist. We acknowledge the discussion on how unmaking is discussed, understood and applied in HCI and what terms are related [see Song et al., 2024]. In this article, however, we disengage from discussing the semantic differences between these notions and other related concepts that we use, including dissecting, to instead focus on the various material and conceptual ways the artworks are presented and how diversely they engage with the discourse on unmaking.

2 Background

In the following section, we will present background information on approaches and bodies of work on unmaking in HCI and its connection to sustainability, and we will describe the connections between art and HCI, how HCI has engaged with posthumanism, and the ties between media art and these various topics.

The concept of unmaking has gained increased interest in HCI, as highlighted, for instance, by the *Unmaking@CHI* workshop in April 2022 [Sabie et al., 2022b]. Sabie et al. divide the approaches to unmaking in HCI into five categories. First, *unmaking as an inevitable occurrence* includes works that deal with immanent processes of the breakdown, obsolescence and decay of designed things, specifically infrastructures [Jackson, 2016] and buildings [Cairns and Jacobs, 2014]. Second, *unmaking as a sustainment agent* showcases the often unrecognised key role of unmaking in design and in sustaining life [Fry, 2003]. Third, *unmaking as elimination for good* is based on the idea of *elimination design*, which critically investigates the complex harmful effects of the multitude of artefacts [Fry, 2008], with strategies being proposed for the disposal of things [Tonkinwise, 2013], or *undesigning* as a series of negotiation strategies for HCI [Pierce, 2012]. Fourth, *unmaking as resistance* is represented by works in HCI that, for example, engage with critical unmaking, which can unravel tensions in an intergenerational urban context that normative design strategies cannot [Sabie et al., 2022a], or a call to action for designers to create friction, through an example concerning designing infrastructures of civic engagement [Korn and Voida, 2015]. Lastly, the category of *unmaking as material innovation* presents material exploratory works that investigate unmaking within digital fabrication [Song and Paulos, 2021] or un-crafting computational things and the insights gained from the process [Murer et al., 2015].

Unmaking is also tied to sustainability through the degrowth movement, making space for alternatives that are “*incompatible with modern capitalist socioecological configurations*” [Feola, 2019], since it raises concerns related to an overabundance of things and a push towards innovation, which consequently implies more artefacts, waste and pollution. Some works, such as Liu et al. [2019], put forth decomposition as a creative approach towards design strategies. Similarly, Lindström and Ståhl [2020] deal with unmaking matters in the *aftermath* of design by composting plastic waste and using plants for phytoremediation, i.e. using plants to clean polluted environments. Furthermore, they explore *un/making through design* as a response to critical environmental challenges by considering the case of the plastic straw and concerns about its disposal [Lindström and Ståhl, 2023]. Others propose *unfabricating*, which addresses concerns regarding sustainability and waste in future smart textile development [Wu and Devendorf, 2020]. An unmaking of products is depicted by Song et al. [2022], who present the design of an interactive system made of entirely decomposable materials, and dissolving as a design opportunity is presented in Lazaro Vasquez et al. [2022]. Fernaeus and Lindegren [2023] conceptualise the above in terms of “*post-industrial aesthetics*” of interaction, captured as an ongoing unmaking, or breakdown, of the modern design ideals.

Art is one of the main modalities through which human culture is mediated, and by engaging with the arts, we “*question human behavior and create awareness of the world around us*” [Oxman, 2016]. HCI and art share the practice of making things, and many art forms are either made from or expressed through interactive technology [Jacobs et al., 2016; Lewis et al., 2023]. In particular, *media*

arts are constantly engaging with new technologies that pervade our contemporary life [Peppler, 2010], as exemplified by the artworks chosen for this study, e.g., the use of AI in *Allochronic Cycles*, AR in *Pranatamangsa AR*, or the ubiquitous smartphone in *Deep Time Walk*. However, while HCI research implies established procedures, formalisation and generalisation, artistic work typically opposes these particularities, and artistic projects studied within HCI have been criticised for instrumentalising the art practice as either “*an object of analysis or as a tool for other ends*” [Britton et al., 2019]. Meanwhile, artistic practice can be argued to hold a unique position for engaging critically with complex concepts in ways that might not be welcome or possible through more conventional research approaches. An example is Jacobsson et al.’s [2013] analysis of the works and concerns of Artbot artists, highlighting fundamental criticism of much relevance to the broader field of human–robot interaction. We also see the conceptual influence of art in HCI through the evolution of the field’s focus, which evolved from first-wave HCI research on tasks, usability, and productivity to investigations of experience and engagement, the so-called third wave of HCI [Bødker, 2006; Harrison et al., 2007]. There is thus a move from a focus on the interface to a focus on the “*human experience and how the design of the behaviour of the system influences it*” [Edmonds, 2018, p. 55]. The current interest in posthuman theory in HCI, sometimes referred to as fourth-wave HCI [Ashby et al., 2019; Bardzell et al., 2021; Frauenberger, 2019; Homewood et al., 2021], also has its reflection in topics explored in the art scene.

Posthuman theory is a result of the transdisciplinary discourse between posthumanism, which is concerned with deconstructing normative representations of ‘the human’, and post-anthropocentrism, which opposes the hierarchical organisation of our ecosystem that has humans at the centre [Braidotti and Hlavajova, 2018]. As a concept that stems from the posthuman, the more-than-human is concerned with human conditions entangled with other living beings, materiality, technology and the environment. In HCI, investigating such entanglements has come into focus [e.g., Frauenberger, 2019; Wakkary, 2021], and this has been proposed as constituting a ‘fourth wave’ of HCI. These theories build upon previous works such as *animal–computer interaction* [Mancini et al., 2017], *multiplespecies interaction design* [Gatto and McCordle, 2019; Mancini and Lehtonen, 2018; Metcalfe, 2015], *posthuman interaction design* [Liu, 2020], *more-than-human-centred design* [Poikolainen Rosén, 2022], or *plant–computer interaction* [Aspling et al., 2016]. These align with nonanthropocentric HCI research [Forlano, 2016; Smith et al., 2017], applying theories such as *natureculture* [Liu et al., 2018] or the *arts of noticing* [Rosén et al., 2022]. Likewise, HCI fundamentally also involves nonhuman things like technology [Coulton and Lindley, 2019; Giaccardi and Redström, 2020]. The increase in these perspectives over the last decade has culminated in discussions on how HCI can turn towards more-than-human perspectives [Yoo et al., 2023], suggesting a paradigm shift within HCI and the human-centred design approach [Coskun et al., 2022].

Within art, Patricia Piccinini’s artwork *We Are Family*, exhibited at the 2003 Venice Biennale, is an example of breaking away from ideas of human exceptionalism by acknowledging nonhuman transgenic creatures [Mondloch, 2018b]. Contemporary art typically engages conceptually with topics of interest in its surrounding culture, creating “*works that challenge our assumptions and, in doing so, ask fundamental questions of us as human beings*” [Edmonds, 2018, p. 63]. Following Sabie et al.’s [2022b] five categorisations of unmaking, the category of *unmaking as resistance* is described by the works of various artists that challenge or bring attention to specific issues, such as *Auto-Destructive Art*, which brings into public discourse issues of nuclear power, pollution and capitalist systems [Wilson, 2008], or *Beautiful Trouble*, a collection of creative engagements from grassroots groups, artists and activists [Boyd and Mitchell, 2012]. Artists are also increasingly engaging with environmental questions [Galafassi et al., 2018]. According to Giannachi [2012], one common strategy in these works is *interventions*, which aspire to encourage reflection or behavioural change by challenging dominant ways of living. Other strategies outlined include

representations, with a focus on visualisations and communication and *performance environments*, with a focus on performance and experience. This shows a shift in the field from works that attest to climate change [Bloom and Glasberg, 2012] to works that encourage action, finding ways to present “*the rendering of something occurring over time, often in remote environments, to diverse and distributed audiences*” [Giannachi, 2012]. Temporality is invaluable in understanding the scientific data related to environmental disruptions, but most importantly, it is critical to finding patterns that unfold over time. In this regard, investigating the changes in a situated context requires a range of practices that artists have developed to look “*at a particular phenomenon both in the here and now and over time*” [Giannachi, 2012].

3 Time as a Concern for HCI

HCI has a rich history of exhibiting the multiplicity of time through investigations such as the *Printer Clock*, *TimeBots*, *Family Clock* and the *Long Living Chair*, all by Larissa Pschetz and her colleagues [Pschetz, 2015; Pschetz and Banks, 2013; Pschetz and Bastian, 2018]. Other examples include the work of Will Odom and his colleagues on longer-term temporality, as expressed in *Olly* and *Slow Game* [Odom et al., 2018], the *Photobox* [Odom et al., 2014] and *Capra* [Odom et al., 2024]. Among more utilitarian concerns are bodies of work that investigate uncertainty in digital scheduling tools through *HAZE* [Bowler et al., 2022] and combine time and space through the *Whereabouts Clock* [Brown et al., 2007]. A continuously reoccurring concept within HCI is *clock time*, or time as a measurable entity, defined as a series of linear events that are quantifiable, measurable and rational. This understanding of time has developed alongside various timekeeping technologies [Lindley, 2015] and is commonly symbolised by a clock. It has thus been used simultaneously as a design material, methodological approach and theoretical lens for advancing research [Wiberg and Stolterman, 2021]. Artefacts presenting clock time, such as clocks and calendars, help structure and organise human life and experience. Researchers, however, have been challenging these perspectives by exposing the temporal inequities and exclusion of certain communities assisted by clock time technologies [Mazmanian and Erickson, 2014; Taylor et al., 2017], focusing instead on the subjective felt experience of time [Pschetz and Bastian, 2018] and slow designs to counteract digitally mediated fast-paced interactions [Hallnäs and Redström, 2001; Odom et al., 2012, 2022; Strauss and Fuad-Luke, 2008].

Another characteristic of time is that it is subjectively felt, shaped by the perception that not all changes are equally experienced [Bastian, 2012]. Similar to how significant events like a global pandemic can distort our sense of time, affecting our sense of rhythm, digital technologies can fabricate the subjective experience of time through their design and usage patterns. This is illustrated by concepts such as *plastic time* presented by Rattenbury et al. [2008]. The concept refers to “*empty time spaces*” that occur when using certain types of technology, e.g., the mindless social media scrolling [Yıldız and Coşkun, 2020]. *Digital time* is another such concept explored by Tomlinson [2007] and Rushkoff [2014] that emphasises constant connectivity and the demand for immediacy in our interactions with digital technologies [Lindley, 2015]. In opposition to this, researchers have presented work in the realm of slow technologies [Odom et al., 2019; Park et al., 2019], with alternative ways of representing [Yıldız and Coşkun, 2020] and perceiving [Loup et al., 2017] time. Other examples include the interactive artefacts designed from the perspective of Wabi-Sabi, which enfolds the realities of *nothing lasts*, *nothing is finished* and *nothing is perfect*, challenging the expectations of timeless perfection, longevity and endurance embraced by physical interaction design [Tsaknaki and Fernaeus, 2016].

Time has also been explored as a fundamental aspect in social relations. Thus, “*it is not that we have or do not have time, but that we make it through practices*” [Puig de la Bellacasa, 2015]. In this sense, methods of measuring time should focus on the aspect of change rather than the passing of time, also considering the agency flow between human and nonhuman actors

[Bastian, 2009; Greenhouse, 1996]. Various temporal aspects within social dynamics, i.e., *right time* and *collective time* [Yıldız and Coşkun, 2020], have been proposed within design research. Taylor et al. [2017] present the right time or the *situational when* as situations that occur under certain “*converging circumstances*”, while Lindley [2015] examine collective time as a play in which various actors coordinate and operate in entangled relations.

Each of the developed perspectives on time is valuable and deserves space for consideration within different scales, both temporal and contextual. However, a perspective that remains a challenge in HCI and calls for more investigation is the posthumanist outlook on time. The recent interest in HCI on this topic [Oktay et al., 2023; Rahm-Skågeby and Rahm, 2022] indicates the need for more engagement with creative practices to address this challenge. In this paper, we explore a family of contemporary media artworks recently exhibited in different settings by different artists or artist collectives, which all, in different ways, present a posthumanist intervention of time. We aim to bring to light the intellectual concerns these works engage with, how these concerns are materially manifested, and what these explorations might bring back to the academic discourse of unmaking in HCI.

4 Research Approach

With the emergence of digital, interactive and mixed-reality art, the contrast between the practices within the disciplines is increasingly blurred [Jacobs et al., 2015]. Whether an artefact or artwork is investigated from an HCI or art standpoint, it is conceptually, socially and politically relevant. It involves understanding the value of the artefact or artwork and its potential to encourage change for one’s work, field or community. Considering that a posthumanist perspective on time is in its early stages in HCI but already has an array of work in the field of art, we take on contemporary media artworks to investigate the following questions: *What theoretical underpinnings and intellectual concerns do these works engage with, and how are they materially manifested? How can these works be seen to unmake time within this discourse, and what are the particular ways that unmaking takes form?* As exemplified by the artworks, they present a blend of materialities and digital, analogue, tangible and temporal theories that we consider relevant for posthuman HCI and its contemporary engagement with time. The selected artworks are fairly recent, from 2011 onwards. Even *Longplayer*, which started on the cusp of the new millennium, is still ongoing.

In the following, we will explore the various forms of knowledge produced by contemporary media artworks concerned with representations of time, using the lens of new materialist philosophies around unmaking in HCI, further developing previous research into the topic of time and the posthuman discourse [Ciobanu and Juhlin, 2022]. Several of these artworks were briefly mentioned in this previous research to showcase related work within artistic practice and used as inspiration for conceptualising a prototype that engages with *nature time* [Ciobanu and Juhlin, 2022]. In this work, however, we expand that pool of artworks to ten projects to perform a critical analysis through the perspective of unmaking. We focus on a collection of works that explore notions of time in more-than-human assemblages, redefining the objective and linear ideas of time that govern human social living through representations that reconnect humans to nature. We focus on this particular case, as we consider it a part of the overarching theme of sustainability, and considering that artworks have an increasing role in engaging the public with sustainability issues, these ideas are particularly relevant for growing the reach of SHCI [Jacobs et al., 2013]. In this case, we find it important to clarify that while nature is a challenging term, we follow the definition in Giannachi [2012], where nature is considered “*as both the environment in which we live and a complex cultural construction, including its data and genetically and technologically modified ‘natures’*”. In this case, we also find Alaimo’s term *trans-corporeality* to be relevant, as it delineates that “*there can be no ‘nature’ outside the human*” [Alaimo, 2018]. This feminist posthumanist concept steps away from

a dualistic view of nature and culture and reflects the “*entangled ethical and political relations*” [Alaimo, 2018] that humans and nonhumans coexist in. As stated by Brenda Laurel on the proposed notion of Gaian IxD [Laurel, 2011], all design work should be grounded in an awareness that we belong to the biosphere, in which “*Technology is not the other*” and “*Nature is not the other*”.

We started the process of gathering artworks by reading the paper abstracts in “*The Material Life of Time*”, the second international temporal belongings conference [Temporal Belongings, 2021], which was an interdisciplinary event with roots in the arts and humanities. We then continued our search through snowballing by looking into the authors of the papers, exploring their work, finding other examples close to the topic, and then starting the process anew until we found sufficient cases to analyse. The conference proved to be a productive starting point, as it tackled the topic from various perspectives, including philosophy. Ten of the fifteen found cases were chosen for more thorough analysis (see Figure 1). The excluded projects were omitted partly because of conceptual overlap with other projects and partly to set a realistic limit to the analysis. This was the case for teamLab’s *Digitized Kairakuen Garden* exhibition [teamLab, 2022]; while it is relevant, it presented quite similar insights to the *A Forest Where Gods Live* exhibition, which is part of our selection of artworks. In like manner, *Circa* [Hunt, 2019] presented similar representations of natural timescales to *The Present* [Thrift, 2022], such as the *The Present - Moon*, but in an app format. Other excluded projects are the *Artificial Biological Clock* [Cohen, 2008] and *Vixen™ Circadian Stopwatch System* [Park, 2012], both intriguing examples of human-centred bodies of work on time, and *The Clock of the Long Now* [Foundation, 1999], a long-term project that engages with the notion of deep time, with a focus on the far future. We also chose to include *Deep Time Walk* and *The Present*, despite leaning more towards interaction design products. For *Deep Time Walk*, we consider the project a contemporary media artwork due to its use of the modern smartphone. Additionally, as described by the art director of the app, Fred Adam, this work is the result of connecting art and science [Deep Time Walk C.I.C, 2017a]. As for *The Present*, defined as a “*functional work of art*”, the project was created using state-of-the-art machinery, such as UV printers [The Present, 2023b] and a programmed “*first-of-its-kind clock movement*” [The Present, 2023a]. Beyond these, we are aware of many other well-known works on the topic. The final ten projects complied with the following inclusion criteria: (1) the project deals with alternative more-than-human representations of time, (2) the project has a technical component, (3) there is enough information to be able to analyse the artwork and interaction and (4) the project is presented and referred to as an artwork.

We started the analysis of the ten selected projects by gathering relevant information on each artwork, starting from the artist’s web page, where the work was presented through other resources, such as media reports and academic articles, where experts and scholars have provided their perspectives. We then categorised the collected data based on the seven criteria listed in Bardzell [2011], which focus on identifying the emotional, intellectual and material qualities of the work, combined with our own experiences and interpretations, what others have written, and how they compare to similar projects and contextualising and pinpointing the temporal theories that are specific to the work. Bardzell transmutes this mingling of subjective and non-perspectival dimensions to criticism in the field of interaction design by presenting four critical perspectives: user, design, interaction and context. As explained by Bardzell [2009], taking these critical perspectives is cumulative towards “*exposing and exploring alternative assumptions*”, cultivating sensitivities towards aspects of design that would be complex to ideate otherwise [Bardzell, 2011], and conceptualising the implications for HCI. We focused on the seven qualities, as they pertain to a broad tradition of criticism and are thus applicable to artworks. We then used qualitative content analysis, a research method used for systematic analysis and pattern identification in various types of content [Krippendorff, 2018], to code the collected data for each project and each dimension. Considering the descriptive nature of the data, coding is suitable for conceptualising relevant insights from the project

descriptions [Saldaña, 2013, p. 88]. The data passed a joint coding round, resulting in 173 codes. We then conducted analytic inductive sessions between the authors for each code to produce categories in terms of our inquiry goals and the theoretical resources on unmaking, which were primarily constituted from Sabie et al.'s [2023] understanding of the concept and the five categorisations of approaches to unmaking in HCI [Sabie et al., 2022b]. This resulted in the conceptualisation of four main underlying themes that pertain to unmaking derived from combinations of related categories.

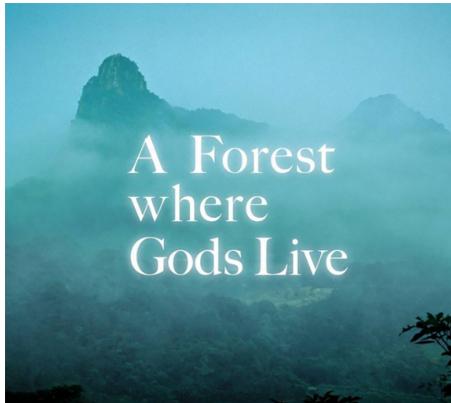
5 Overview of the Artworks

In this section, we will briefly describe each artwork, with a specific focus on the main temporal idea behind the piece and its material, perceptual and meaningful qualities. A shorter description of the artworks can be found in Table 1.

teamLab: A Forest Where Gods Live. This exhibition (see Figure 2), created by an international art collective founded in 2001 called teamLab [teamLab, 2019a], has been held every year since 2015 at Mifuneyama Rakuen Park, with more artworks created and added to the exhibition every year. Unlike typical exhibition venues, it is located in a remote part of Kyushu, Japan and encourages visitors to come to the exhibition site. This work follows a current trend in Japan in which contemporary art is used to reanimate traditional and religious sites [Lee, 2022, p. 162]. teamLab uses real-time animations and projections to construct interactive and immersive experiences in their exhibitions [Li, 2020]. They superimpose non-material digital art on various natural forms of the park, such as rocks, caves, forests and gardens, without harming the natural environment. With more than 20 works featured in the *A Forest Where Gods Live* exhibition, nature is made into art in its natural state; for example, azalea bushes light up and change colour in response to visitors approaching them in *Life is Continuous Light* (see Figure 2(e)), and cherry blossoms and maple trees light up in different colours as the visitors approach the trees or walk along the main path in *Resonating Forest—Cherry Blossoms and Maple* (see Figure 2(c)). These various installations are specifically noticeable after dark when they transform the natural forms of the park. The exhibition engages with time in various ways, either through the installations, which include representations of the plant life cycle through the projections of blossoms that grow, flower, and eventually wither in *Ever Blossoming Life Rock* (see Figure 2(d)), transposing various timescales that are in the space with digital projections, such as the history of the ruins, with column constructions that serve as three-dimensional displays in *Megaliths in the Bath House Ruins* (see Figure 2(f)), or through conceptually engaging with deep time by using light and sound on the mountain in *Resonating Mt. Mifuneyama* (see Figure 2(e)).

Allochronic Cycles. This kinetic installation (see Figure 3) was created by the Cesar & Lois collective in 2020 and exhibited at the Chronus Art Center as part of the exhibition 'AI Delivered: Redemption' (2021–2022). It is an artwork that responds to humans' lack of synchronicity with nature and the planet and uses artificial intelligence to expand the human understanding of nonhuman timescales. The AI predicts the impact of modern human societies on environmental timescales, presenting the possibility of AIs learning from complex ecological systems. The installation is composed of four discs that follow a cyclical pattern of time for various natural timescales, such as the cosmos, the planet Earth, the plant Arabidopsis and COVID, with each disc having a different pattern of divisions [Cesar and Lois, 2021]. The first disc, which represents the cycle of the cosmos, has 31 divisions, each representing a key element in the development of the cosmos, such as *Sun and Planets Form* and *Significant Oxygen in Atmosphere*. The second disc represents the growth cycle of the Arabidopsis plant, with some of the stages being *Seed Germination*, *First Flower Opens* and *Decay Complete*. The third disc (see Figure 3(b)) spins according to the life cycle of the COVID-19 virus, which includes *Virus Production and Cell Signaling*, with its molecular structure carved into

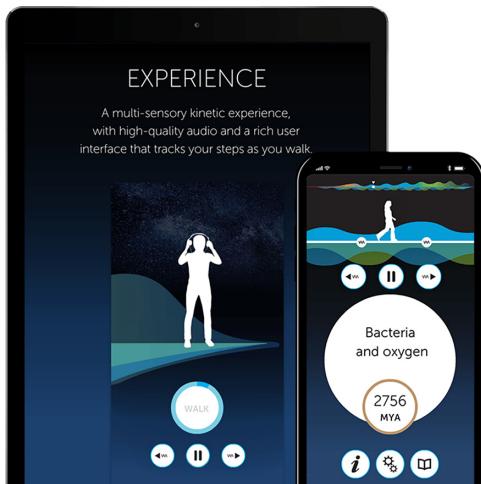
Table 1. Short Description of the Media Artworks



teamLab: A Forest Where Gods Live by teamLab is an exhibition that includes more than 20 digital works of art overlayed on various elements of Mifuneyama Rakuen Park, such as rocks, forest or mountain. Image credit: screenshot used with permission ©teamLab [teamLab, 2019a]



Allochronic Cycles by Cesar and Lois is an installation composed of four discs that represent temporalities of the cosmos, planet Earth, Arabidopsis plant, and COVID, with an AI component that learns from these various cycles and affects them based on discrepancies between human time and ecological time. Image credit: ©Cesar & Lois [Cesar and Lois, 2021]



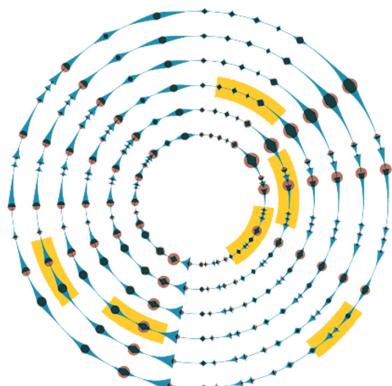
Deep Time Walk is a walking app created in collaboration between Robert Woodford, Geoff Ainscow, and Fred Adam. The work presents an audio narrative that guides the listener on a 4.6 km walk during which the history of the Earth is recounted. Image credit: ©Deep Time Walk CIC [Deep Time Walk C.I.C, 2017b]

(Continued)

Table 1. Continued



Keeping Time by Tega Brain is a visualisation of photos posted on Flickr of various plant species. The photos of a specific plant are arranged based on the timestamp, showcasing the times in a year when the plant is more photographed and thus observed. Image credit: ©Tega Brain [Brain, 2013]



Longplayer by Jem Finer is a musical composition scored to play for 1,000 years until it completes its cycle and starts again. Longplayer started playing at midnight, 31 December 1999, at the International Date Line, UTC +12, on the last instant of the last millennium and the first instant of the next. The artwork can be listened to online, via an app, or at various listening posts around the world. Image credit: ©Jem Finer [Finer, 1999]



Pranatamangsa AR by Anna Madeleine Raupach is a set of twelve black and white prints that present night sky simulations for each period in an Indonesian farming calendar. Each print has a corresponding animation that can be seen in AR, which shows the agricultural activity or event in nature occurring at that time. Image credit: ©Anna Madeleine Raupach [Raupach, 2018b]

(Continued)

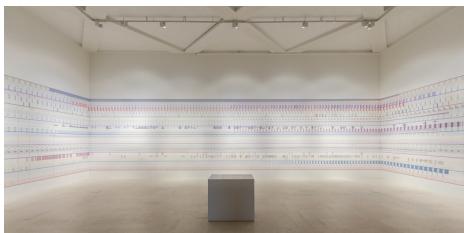
Table 1. Continued



The Phenology Clock is an artwork created in collaboration between Natalie Jeremijenko, Jake Richardson, Blacki Migliozi, Tega Brain and others. In this project, the standard clock units are replaced for the months in a year, presenting how various species bud, bloom, emerge or migrate. Image credit: ©Tega Brain [Brain, 2011]



The Present by Scott Thrift is a collection of three different clocks that present the cycle of a day, phases of the moon, and the four seasons in a year through colour gradients. Image credit: ©The Present [The Present, 2024]



The Room of Change by Accurat is an installation that physically visualises data related to nature, the universe, the animal kingdom, society, hope, happiness, science and technology. The artwork visualises different events within these topics from the past, present, and future predictions. Image credit: ©Triennale Milano - photo Gianluca Di Ioia [Lupi, 2019]



Unequal Hours by Anna Madeleine Raupach is an installation that showcases dozens of clocks interconnected through ribbons. Each clock follows a certain timescale, such as the eclipse cycle, and is connected to associated clocks, like the clocks for the solar cycle and the moon's orbit. Image credit: ©Anna Madeleine Raupach [Raupach, 2021]

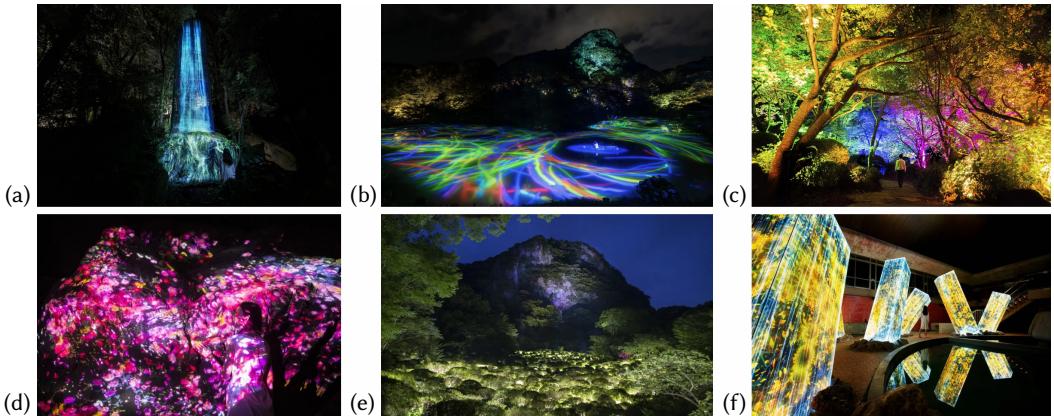


Fig. 2. Selection of installations in the *A Forest Where Gods Live* exhibition: *Universe of Water Particles on a Sacred Rock* [teamLab, 2017d] (a), *Drawing on the Water Surface Created by the Dance of Koi and Boats* [teamLab, 2015] (b), *Resonating Forest—Cherry Blossoms and Maple* [teamLab, 2017c] (c), *Ever Blossoming Life Rock* [teamLab, 2017a] (d), *Resonating Mt. Mifuneyama* [teamLab, 2018] and *Life is Continuous Light* [teamLab, 2017b] (e), *Megaliths in the Bath House Ruins* [teamLab, 2019b] (f) ©teamLab.

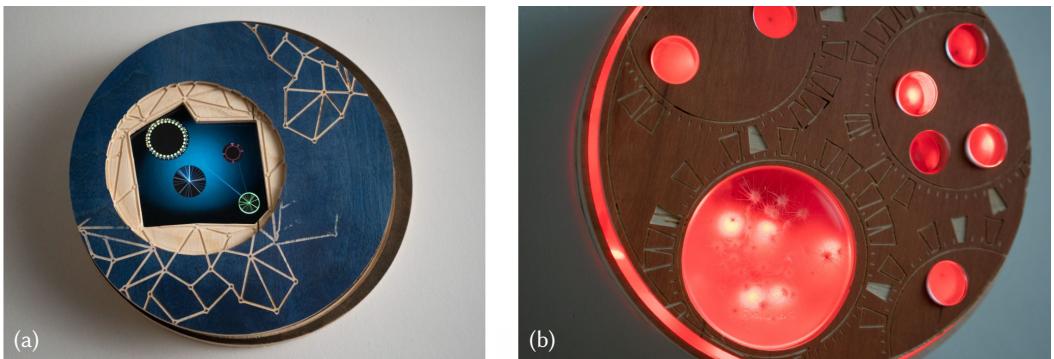


Fig. 3. Two components of the *Allochronic Cycles* artwork: the AI component (a) and the rotating disc that follows the life cycle of COVID-19 (b). ©Cesar & Lois [Cesar and Lois, 2021].

the disc. The last disc includes concentric circles showing the layers of the soil, and each division on the disc indicates a significant planetary event, such as the *Big Bang*, *Formation of the Earth*, *First Mammal* and *Anthropocene*. The last component of the installation, with the only non-rotating face, is the AI (see Figure 3(a)), which oversees and interacts with the four discs and changes their cycles depending on measurements of the atmospheric carbon levels.

Deep Time Walk. This work is a walking app (see Figure 4) that supports an audio experience of a history of the living Earth “*across space and time*” [Deep Time Walk C.I.C, 2017c]. This project was started in 2007 by Dr. Stephan Harding and the MSc student, geologist Sergio Maraschin. Later on, *Deep Time Walk* app was designed as a result of a collaboration between Robert Woodford, Geoff Ainscow (Walk Through Time project leader), and Fred Adam (expert in using smartphones for walking across time and space) [Deep Time Walk C.I.C, 2017]. The project presents a guided walk to experience and understand deep time: “*a transformative journey through 4.6bn years of Earth history via a 4.6 km guided walk*” [Deep Time Walk C.I.C, 2017a]. Every metre of a *Deep Time Walk*

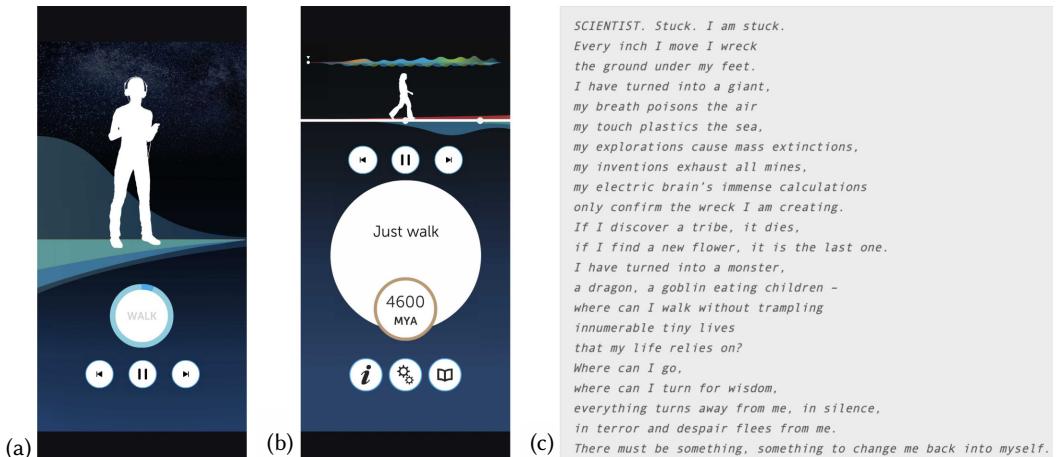


Fig. 4. Screenshots of the app right before the walk (a) and during the walk (b), with an excerpt of the script from the audio narrative (c). ©Deep Time Walk CIC [Deep Time Walk C.I.C, 2017a].

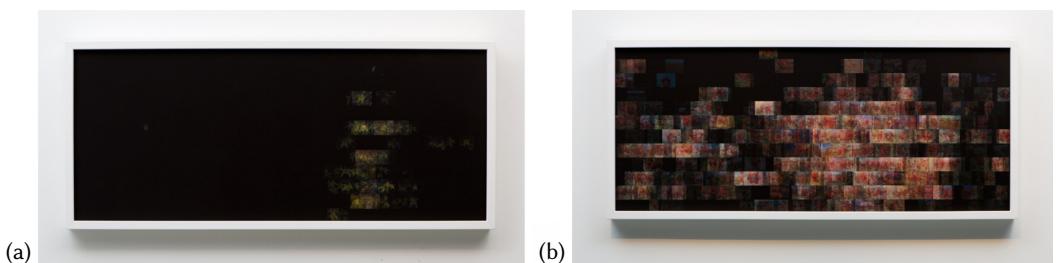


Fig. 5. Visualisations of the species visibility of the Cowslip Orchid (a) and Sturt's Desert Pea (b) for the period 2002–2013. ©Tega Brain [Brain, 2013].

equals 1 million years, with the app adjusting the soundscape of the narration according to the walking pace and distance based on the pedometer built into the phone (see Figure 4(a) and (b)). In the experience, the body is used to measure the last million years, with the final 200,000 years being equal to 20 cm and representing the approximate time our species, *Homo Sapiens*, has been on the Earth. The metaphor of distance for the Earth's geological timeline helps users gain perspective on the Earth's age and history. It challenges the human-centred nature of history, with nature as simply the background for the unfolding of this history [Opus Earth, 2017]. As an “*intercultural story-telling platform*” [Deep Time Walk C.I.C, 2017a], it is quite theatrical in its experience, with the audio narrative presenting a dramatised interpretation of time delivered by the characters of the *Scientist* and the *Fool* (see Figure 4(c)).

Keeping Time. This artwork (see Figure 5) was created by artist Tega Brain in 2013, and it represents how humans see other species. Created in a time when biological events have digital traces [Brain, 2013], the visualisation in *Keeping Time* is not solely the result of the social relationships with plant species but also an indicator of how the environment is changing [Brain, 2017]. It represents time as layers, with each row representing a year. Within the year, we can see the combination of all the images tagged with a specific species name aligned according to the timestamp. The phenological patterns of particular plant species are conveyed based on photos posted on Flickr [Brain, 2013]. Figure 5(a) portrays how the Cowslip Orchid is rarely photographed,

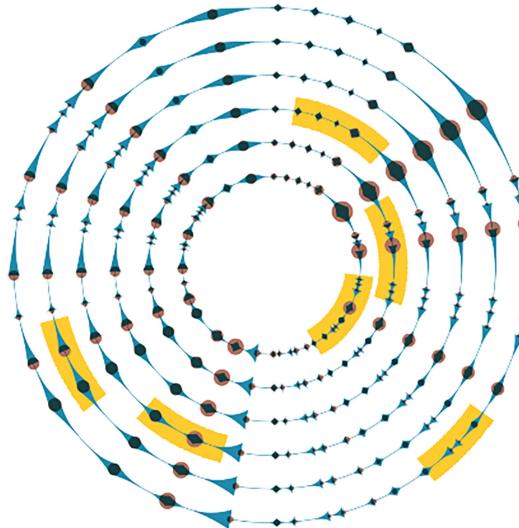


Fig. 6. Graphic depicting the plan view of the singing bowls. ©Jem Finer [Finer, 1999].

with images appearing only around September. In contrast, the Sturt's Desert Pea is much more visible throughout the year, with abundant images taken in the summer months. Works such as *Keeping Time* are important to understanding how the local climate changes different species' cycles and how these disruptions eventually disrupt the multispecies interrelationships that depend on synchronised cycles. It shows the patterns of plant visibility for humans, which usually focus on certain moments of their life cycle, such as during blooming in spring or during autumn when the leaves turn red, and then their life cycle ends [Brain, 2013]. Most of the time, we experience seasonal plant blindness, remaining unaware of plants.

Longplayer. This musical artwork (see Figure 6) was composed by Jem Finer using singing bowls. The composition started on 1 January 2000 and is set to continue without repetition until 2999, when it will complete its first cycle [Finer, 1999]. The musical composition will thus take 1,000 years to complete. The title of the work is an intentional choice, referencing the amount of time it will take for the composition to finish; it is a “gigantic loop, biting its own tail once every millennium” [Christenhusz, 2021]. The work consists of six pieces of music, each with a different tempo and duration, orbiting each other like planets in a solar system for a thousand years until they reach the common starting position, which is graphically represented in Figure 6. This process is ensured by moving the starting point of each piece of music ahead every two minutes. This project is comparable to six turntables or an analogue clock but with six hands [Cox, 2021]. *Longplayer* attempts the challenge of representing time that goes beyond the human lifespan and many generations of humans through the metaphor of music. It takes an analogous approach by representing the continuity of time by arranging the singing bowls in concentric circles, resembling the solar system, with the sun as an important reference point for time passing. This composition is accessible via an online live stream and an app, with the composition being generated on the user’s phone. It can also be listened to at certain public listening posts.

Pranatamangsa AR. This artwork (see Figure 7), created by artist Anna Madeleine Raupach in 2018, is an animated interpretation of an Indonesian farming calendar, connecting the various natural events and agricultural activities in the calendar to astronomy observations [Raupach, 2018b].



Fig. 7. One of the twelve prints showing the night sky simulation [Raupach, 2018b] (a) and the AR app screenshot [Raupach, 2018a] (b). ©Anna Madeleine Raupach.

The work showcases how the Pranatamangsa calendar system is threatened by changing climate conditions. It is composed of twelve prints of star maps that correspond to an amalgamation of natural changes and agricultural activities described in the Javanese and Sundanese farming calendars. Essentially, it is an association between the night sky's star map and the agricultural or natural phenomena happening at that specific time of the year [Raupach, 2018a]. Positioning the cosmic phenomena in contrast with day-to-day activities is intended to question and expand our perception of time. Each print has an AR component that triggers an animation that shows the corresponding agricultural activity or an event occurring in nature related to the flora, fauna, or change in seasons [Raupach, 2019]. The artwork, specifically the use of AR in the project, allows one to explore the prints chronologically or otherwise.

The Phenology Clock. This artwork (see Figure 8) was created by Natalie Jeremijenko, Jake Richardson, Blacki Migliozzi, Tega Brain and others as part of a project on how health and the environment are dependent on each other [Brain, 2011]. It deconstructs the ordinary clock by replacing the standard clock time units with the twelve months of the year. Thus, January corresponds to the twelve o'clock mark, with only one arrow on the clock face moving through the months. Following the cyclical quality of phenology, the clock supports a nonhuman understanding by representing the various urban species of a local environment that bud, bloom, emerge, or migrate and how their lifecycles are seasonally interdependent processes [Moline et al., 2015]. As shown in Figure 8, each species is assigned a colour and is placed in a specific concentric circle, starting with trees and urban mammals in the outer circles and ending with fungi and microbes in the innermost circles. While natural systems continuously change, the clock comprehensively represents this [Agapakis, 2015]. The piece is considered a more participative way of recording and



Fig. 8. Two Phenological Clocks display the life cycle events of local urban organisms in Sydney (left) and New York (right) based on data collected between 2000 and 2014. ©Tega Brain [Brain, 2011].

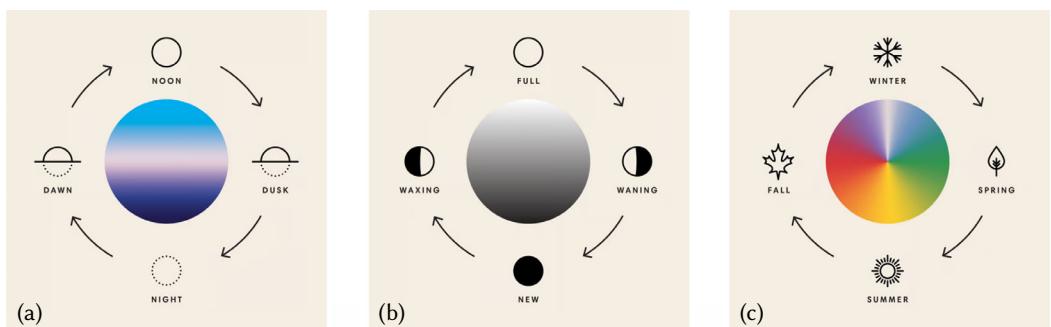


Fig. 9. The cycle of a day (a), the phases of the moon (b), and the cycle of a year (c). ©The Present [The Present 2024].

learning about these various patterns than traditional scientific methods. As the artist Tega Brain writes, “[t]he practice of observing recurring environmental patterns builds an ecological perspective of time constituted by cycles and relationships rather than the steady, linear march of machines” [Brain, 2019].

The Present. This functional artwork is a collection of three clocks (see Figure 9) created by Scott Thrift that tell time through the use of colour and gradients rather than seconds, minutes and hours [Thrift, 2020]. *The Present - Day* (see Figure 9(a)), introduced in 2016, is inspired by an image of looking at the clouds from an aeroplane in flight [Barnes, 2016]. It moves at half the speed of an ordinary clock as one hand goes through the 24 hours of the day. The clock fragments time into dawn, day, dusk and night, represented through a blue gradient that conveys the change from day to night. *The Present - Moon* (see Figure 9(b)), introduced in 2020, follows the moon cycle, with the hand of the clock in the light during a new moon and in shadow during a full moon [Thrift, 2020].

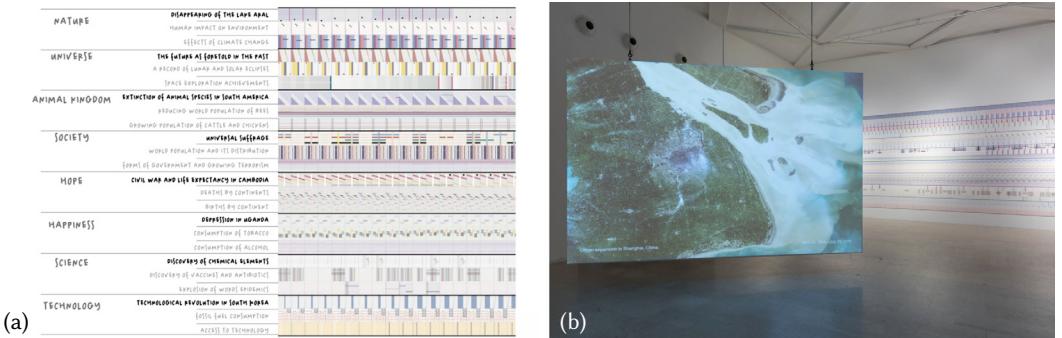


Fig. 10. Part of the legend explaining the data visualisation ©Giorgia Lupi (a) and the exhibition (b) ©Triennale Milano - photo Gianluca Di Iorio [Lupi 2019].

It was inspired by the ancient symbol of non-duality, yin-yang, evoking “*the interconnected oneness of all things*” [Han, 2020]. Lastly, *The Present - Year* (see Figure 9(c)) addresses the idea of the circularity of time by presenting a clock that is focused on the natural passing of time, specifically by switching the hours for the seasons of the year with a single hand moving through hues of blue, green, yellow and red. Thus, short intervals, usually associated with clock time, are now visualised as a “*unified, colorful spectrum mirroring the seasons of the year*” [Pavlus, 2011]. The colour hues represent Spring, Summer, Autumn and Winter, with the Winter Solstice at the top marked by white, the Summer Solstice at the bottom marked with pure yellow, and the Spring and Fall Equinoxes on each side marked with pure green and red [Marchese, 2020]. Thrift explains how the mechanism for the annual movement of the clock had to be invented, as it did not exist before, along with software that would set the clock to the day that it was turned on, i.e., “*to the present*” [PSFK, 2013].

The Room of Change. This artwork (see Figure 10) was created by the data design studio Accurat as an introductory installation for the 22nd Triennale Milano International Exhibition *Broken Nature: Design Takes on Human Survival*, in 2019. It is a collection of stories and relationships between humans, technology and nonhuman beings. The 30-metre-long hand-crafted data tapestry has a snapshot of a particular moment in time on each vertical section, and each horizontal section follows a story as it evolves through time, visualising events of the past, present and future [Lupi, 2019]. The data-based visualisation depicts eight topics: *nature*, *universe*, *animal kingdom*, *society*, *hope*, *happiness*, *science* and *technology*. Each topic in *The Room of Change* has three underlining events represented through a visual pattern, e.g., for nature, the events are *the disappearance of the Aral Sea*, *the human impact on the environment* and *the effects of climate change* (see Figure 10(a)). The artwork is supplemented by a legend explaining how to read the individual stories [Accurat, 2019b]. In addition to the data tapestry, *The Room of Change* is also accompanied by two large screens that show a selection of before-and-after images from the NASA Archive that present the results of melting glaciers or urbanisation that have happened in the past 20 years [Bradley, 2019] (see Figure 10(b)). These larger-scale projections contrast with the contextual story of change depicted in the visualisation. *The Room of Change* considers the complexity of entanglements between global and local phenomena and collective and individual perspectives, showing the change that is constantly occurring at these various levels [Accurat, 2019a]. This artwork reveals how change is composed of incremental moments rather than being an objective and universal fact that is usually shown to us from “*far away and high above*” [Pentagram, 2019].

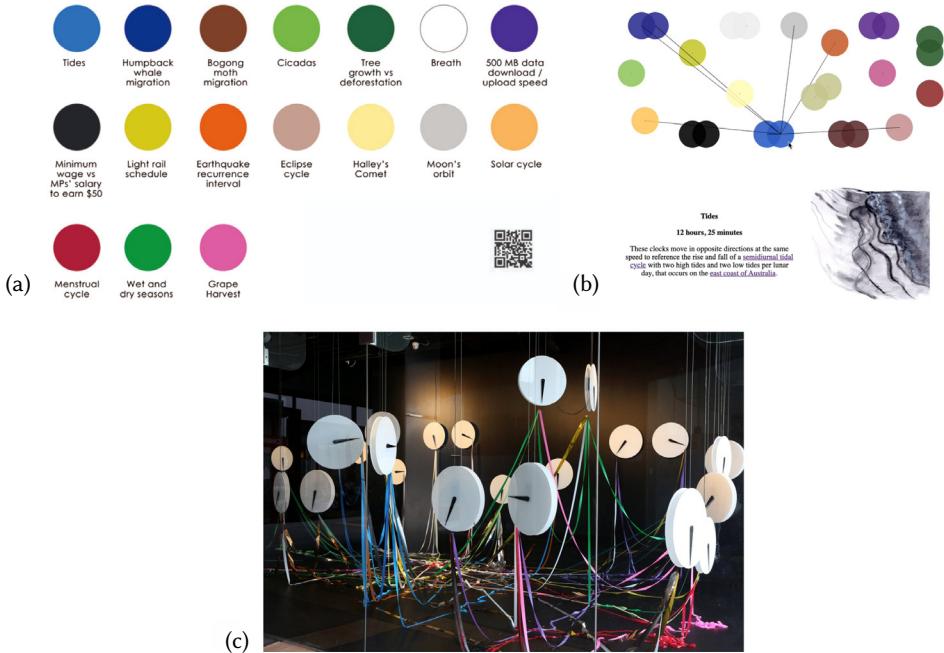


Fig. 11. Overview of the various clocks (a), screenshot from Raupach [2022] (b) and the exhibition (c). ©Anna Madeleine Raupach [Raupach 2021].

Unequal Hours. This room-size installation (see Figure 11), created by artist Anna Madeleine Raupach in 2021, is a vivid representation of how alternate timescales intersect, explicitly showing how various natural forms intersect with human clock time while operating on alternate timescales [Raupach, 2021]. Presented at the Canberra Museum and Gallery in 2021, it includes mechanical clocks hanging from the ceiling, each with a single arrow, moving in their own cycles and connected by coloured ribbons. The name of the piece, *Unequal Hours*, is a time concept used before tools for synchronisation and coordination, such as clocks, were designed. Each clock represents a natural, human, or technological timescale [Raupach, 2021] (see Figure 11(b) for an overview of the various timescales). The clocks present natural timescales such as whale migration, the moon's orbit, and eclipse cycles, and human timescales such as breathing, the menstrual cycle, grape harvesting and population growth and decline.

6 Analysis

Here, we will present our analysis of the artworks based on our research questions. This analysis thereby focuses on what theoretical underpinnings and intellectual concerns these works engage with, how they can be seen to unmake time within this discourse, and how unmaking takes form. Following the critical analysis of these artworks, we conceptualised four themes: *dissecting temporality*, *the unmaking of the singular*, *unmaking as messing up* and *unmaking the other*, with each theme consisting of three subtopics. We will thus dive into what each theme represents and the role that unmaking plays in it. An overview of the key insights from the four main themes is provided in Table 2, with a larger scale of the media artworks in Figure 12.

Table 2. Overview of the Key Ideas from the Four Main Themes Conceptualised in the Analysis

Theme	Subtheme	Overview
Dissecting Temporality	Multiple Orientations	<ul style="list-style-type: none"> –Steers between relations of past, present, and future, such as in <i>Allochronic Cycles</i> and <i>Deep Time Walk</i>, and engages with the challenge of dividing one's perception between these multiple temporal orientations –A similar multiplicity is shown in <i>The Phenology Clock</i> through the variety of species and their temporalities and in <i>The Present</i> with its support for alternative experiences of being in time, past, or future
	Multiple Dimensions	<ul style="list-style-type: none"> –This subtheme grapples with ideas of scale. Human and other-than-human timescales are superimposed in works such as <i>A Forest Where Gods Live</i>, <i>The Room of Change</i>, <i>Longplayer</i>, and <i>Deep Time Walk</i>. This approach is used to position the human timescale in relation to greater scales to stimulate emotions and reflections on the human impact on natural systems. –We bring out the notion of the hyperobject and its various characteristics in reference to the musical composition <i>Longplayer</i> and the full-body experience of deep time in <i>Deep Time Walk</i>.
	Multiple Temporalities	<ul style="list-style-type: none"> –This subtheme underlines how multiplicity is pervasive across the artworks, with additional investigations on how <i>Longplayer</i> and <i>Deep Time Walk</i> engage with sound to attune to temporalities that exceed human timescales. –Interconnections between human and nonhuman temporalities in <i>Unequal Hours</i>, <i>The Present</i>, and <i>A Forest Where Gods Live</i>
Unmaking of the Singular	Plurality in Materials	<ul style="list-style-type: none"> –Materialisation of story-telling through time-based media such as <i>Pranatamangsa AR</i> –Tangible representations of a cyclical view of time in <i>The Present</i> –Artificial life forms seeking methods for survival, such as <i>Longplayer</i>, or that create themselves possible worlds, like <i>Allochronic Cycles</i>
	Plurality in Representation	<ul style="list-style-type: none"> –Artworks that show the quality of adaptability in their design, such as <i>The Phenology Clock</i>, which presents the lifecycles of the plant and animal species of a local area, or <i>Longplayer</i>, which aims to endure through technological obsolescence and social change –Artworks that present resilience through a long-term thinking perspective, such as <i>The Present</i>, which was constructed to work for a long time autonomously, <i>The Room of Change</i>, which represents data of a speculative future in 2400, or <i>Deep Time Walk</i>, which engages the listeners in future thinking through a walking audio experience of geological time –Artworks that present gentle and undemanding representations of time, such as <i>A Forest Where Gods Live</i>, where nature is portrayed in a calming visual style, or <i>The Present</i>, which considers a simplified representation of seasonal, circadian, and lunar cycles –Artworks that engage with conceptions of space-time, such as perceptions of being frozen in time in teamLab's work, <i>The Room of Change</i>, <i>The Present - Year</i>, and <i>Deep Time Walk</i>. Except for <i>The Room of Change</i>, these artworks either represent the idea of the slow flow of time, such as in teamLab's work, or engage users to experience slowness and slow down, such as in <i>The Present</i>, <i>Deep Time Walk</i>, and <i>Longplayer</i>. –Suggests how <i>Deep Time Walk</i> breaks human/nature and mind/body dualisms through its place-based and adaptable locative media, while teamLab's exhibition engages its visitors in expressions of play and traces of rituals –Artworks that are a result of transdisciplinary work between art, science, and technology, such as <i>Deep Time Walk</i>, <i>A Forest Where Gods Live</i>, and <i>Allochronic Cycles</i>
Unmaking as Messing Up	Entanglements in Practice	<ul style="list-style-type: none"> –Artworks like <i>The Present</i> and <i>Deep Time Walk</i> engage with the challenge of temporal illiteracy by advancing alternative understandings of time and subscribe to the teaching practice of the four ways of knowing in the case of <i>Deep Time Walk</i>. –Artworks like <i>A Forest Where Gods Live</i> and <i>Pranatamangsa AR</i> make use of SAR to create immersive installations with blurred boundaries between the overlayed digital materials and the natural physical forms in the former, and seamless interfaces that present a multilayered environment in the augmented world in the latter. The augmentation is also manifested in <i>Deep Time Walk</i> through the immersive audio narrative.
	Entanglements in Knowledge	<ul style="list-style-type: none"> –Variety of human-nonhuman associations through a kinesthetic entanglement between various timescales of physically linked clocks in <i>Unequal Hours</i> –Variations of cycles that include circadian, lunar, and seasonal cycles in <i>The Present</i> –Interdependencies between local urban species are represented in <i>The Phenology Clock</i>, while <i>Keeping Time</i> focuses on nature-culture connections. –<i>A Forest Where Gods Live</i> navigates connections between visitors, art, and place. –<i>Deep Time Walk</i> presents the entanglement of humans with the history of the Earth. –<i>Longplayer</i> portrays the dependency of its survival on human demand.

(Continued)

Table 2. Continued

Theme	Subtheme	Overview
Unmaking the Other	Searching for New Perspectives	<ul style="list-style-type: none"> —Artworks encourage reflection on conventional ideas of time through design in <i>Keeping Time</i>, with additional attunement to the cyclical nature of time in <i>The Phenology Clock</i> and <i>The Present</i>. —Artworks such as <i>Longplayer</i> and <i>Deep Time Walk</i> take a sonic approach to introduce the listeners to deep time and harmonise us to rhythms of a large scale. —<i>Pranamatangsa AR</i> unravels how the evolution of technology, such as animation, shapes our understanding and experience of time.
	Searching for Disseminating Tools	<ul style="list-style-type: none"> —This theme focuses on the various material strategies used to diffuse alternative ideas. —<i>Keeping Time</i> and <i>The Phenology Clock</i> make use of data visualisation to intervene between anthropocentric living and make space for representations of nature-culture interdependence. These artworks encourage users, no matter the generation or discipline, to create interest surrounding more-than-human concerns, with <i>Deep Time Walk</i> presenting a variety of functionalities that make the experience much more accessible and resources to continue diving into the topic or offering the ability to engage in the discourse actively. —The use of animation in <i>Pranamatangsa AR</i> is examined, along with the use of this tool in science communication and representations of future alternative temporalities.
	Searching for Signs of Life	<ul style="list-style-type: none"> —Brings forth traditional beliefs that animate natural forms, such as trees and rivers in the case of <i>A Forest Where Gods Live</i> —Expresses the Gaia hypothesis through the embodied audio experience in <i>Deep Time Walk</i>

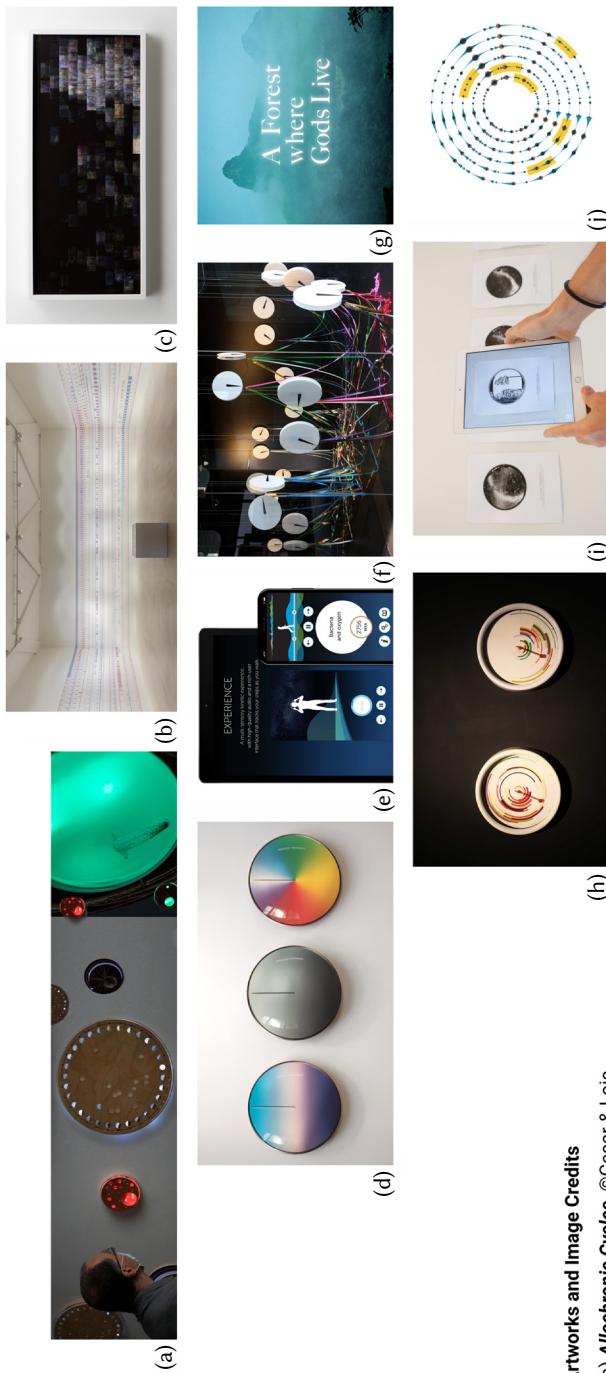


Fig. 12. Media artworks explored for the material and conceptual insights in the discourse of unmaking.

6.1 Dissecting Temporality

This theme is focused on deconstructing the singular ideas of time by concentrating on the multiple. This idea of multiplicity is rooted in, for example, Tsing's engagement with polyphony as a noticing of how various melodies synchronise or clash, matching to the "*multiple temporal rhythms and trajectories of the assemblage*" [Tsing, 2015, p. 24]. It is also a key aspect in Alaimo's concept of transcorporeality, which is maintained by "*multiple horizontal crossings, transits and transformations*" [Alaimo, 2018]. This is followed by a disposition in HCI to develop a "*multiple timescale sensibility*" to assess the long-term impact of technologies [Rahm-Skågeby and Rahm, 2022]. The creators of *Allochronic Cycles* mention how, in the process of creating the piece, they have '*dissected*' time and '*decoded*' the temporal perspectives of species such as *Arabidopsis* and lichens [Cesar and Lois, 2021]. Similarly, teamLab's exhibition explicitly points to traces of unmaking in installations such as *Megaliths in the Bath House Ruins* [teamLab, 2019b] and *Ever Blossoming Life Rock* [teamLab, 2017a] by portraying perpetual cycles of growth and decay. We thus unpack how temporality is unmade in the selection of artworks by looking at the *multiple orientations* in and through time, the *multiple dimensions* of engaging with scale, and the *multiple temporalities* that the artworks represent.

6.1.1 Multiple Orientations. There is a certain connection between the past and future embedded in the artworks in various ways. Some users of *The Present* described how the artwork supported an appreciation for the past and looking forward to the future [The Present, 2023c]. In *Allochronic Cycles*, the creators maintain that in order to "*move forward, we look backwards across millennia*" [Cesar and Lois, 2021], with the AI predicting the future human impact on the various timescales represented by the four other discs according to atmospheric carbon levels. In other ways, artworks such as *The Phenology Clock* illustrate the multiplicity of other species and thus present opportunities to develop tools that embrace this multiplicity rather than holding on to solely human timescales. We also identified how artworks like *The Present* take on experiential conceptions of time. This relates to the discrepancy between being on time, which is supported by conventional and linear time-telling tools, and being in time, which is encouraged by artefacts such as *The Present* that source new perspectives on various challenges, which are primarily environmentally related. We see this combination in other works such as *Deep Time Walk*. The experience with the app focuses on presenting an embodied way of engaging with deep time, using deep movement, as opposed to being static and fixed like clock time [Opus Earth, 2016]. While some features in the app, like the Millions of Years Ago Indicator, represent the standard idea of time, these blend seamlessly with the other features in the app without taking away from the main goal: to experience deep time.

6.1.2 Multiple Dimensions. The artworks engage with scale in various ways. teamLab intentionally uses natural forms that embody long periods of time, such as rocks and trees, in their exhibition, as these are materialisations of spans of past time flowing into the continuous present. Thus, when including natural timescales and natural forms that are on a grander scale and surpass the human timescale, we can position ourselves in the long continuity of time [teamLab, 2019a]. Thus, deep time as a *threshold concept* [Meyer and Land, 2003] launches new ways of thinking and understanding the world. However, by introducing a deep time perspective, an unavoidable friction is created, related to how, on the one hand, humanity is simply an insignificant blip on the geological timescale. On the other hand, the human impact has been enormously powerful for such a small amount of time.

To understand the entanglement of multiple temporalities, such as ecological time, the philosopher Timothy Morton introduces the concept of hyperobjects, which are defined as "*things that are massively distributed in time and space relative to humans*" [Morton, 2013, p. 1]. A characteristic

of hyperobjects is their *temporal undulation*, which occurs incrementally due to their dimension, making it seem as if they happen extremely slowly [Morton, 2013, p. 55]. As a result, we can experience a fragment of the hyperobject but never its entirety. Climate change is an example of a hyperobject. As something massive in its space-time proportions, it is not sensorially perceivable. Through *Longplayer*, Finer encourages us to attune to hyperobjects, such as climate change, that are undeniably pressing challenges. However, considering the size of the composition, the artwork is in itself a form of hyperobject, as we can only experience a fraction of it, expressing “*a certain kind of musical anti-optimality*” [Koutsomichalis, 2018]. Thus, hyperobjects imply a complex entanglement of temporalities, of which humans are a part.

Various metaphors are used to translate scale, such as creating experiences involving the physical movement of the body as a reference point or measuring tool. This approach is one way to unravel the *threshold effect* caused by how “*hundreds of millennia and millions of years takes us well beyond the scope of direct human experience*” [Trend, 2001]. While various metaphors have also been used as a solution to this challenge, such as representing deep time as a clock or calendar, these numerical or written representations fall behind compared to full-body experiences or *corporeal ways of knowing* [Pink et al., 2010]. *Deep Time Walk* draws from these points and engages the body in perceiving deep time. There is also a specific sound that indicates when the storytelling is paused, with the audio narrative matching the pace of the listener’s movement. However, due to the loaded descriptive narration, it is similar to listening to a scientific audiobook, making it hard to concentrate on what is said. Nevertheless, sound is essential for exploring temporality, place, interactions and interdependence. Taking a sonic approach to engaging with the Anthropocene “*brings into the world novel relations, it shifts paradigms and builds new formations*” [Kanngieser, 2015].

The Room of Change depicts change through various scales and dimensions, with a legend that explains the data visualisation, which is crucial for allowing a visitor to understand and ‘see’ the artwork. This project impresses visitors and sparks emotions and reflections on the social and natural changes in our world’s past, present and future. It does so by presenting a visualisation that mentions no numbers, and it is unclear what the different bands mean until one reads the legend. As a combination of “*objective data and artistic presentation*”, the sheer scale of the work leaves visitors experiencing “*data vertigo*” [Kennedy, 2019]. This piece represents the world from both global and local perspectives [Pentagram, 2019]. It is more visible than other artworks due to its physical nature and scale. The artwork also provides the possibility for interactions of different durations. They can be long term, as reading the legend, understanding the data and going through different moments takes time. At the same time, they can be short term, as the user can target a specific period or topic, switch between past, present, or future changes, or avoid a topic altogether.

6.1.3 Multiple Temporalities. Artworks such as *Deep Time Walk* and *Longplayer*, due to their acoustic experiences and the added embodied experience in *Deep Time Walk*, present opportunities to sensorially attune to non-anthropocentric temporalities that usually exceed our cultural frames of reference [Christenhusz, 2021]. As listening is an affective and embodied practice of engaging with the world [Voegelin, 2010, p. 3], *Longplayer* enables us to “*share time and space with the object or event under consideration*” [Christenhusz, 2021]. A sonic experience thus occurs and is felt in time, with sound fostering sensitivity towards otherwise unreachable timescales. Additionally, concerning scale, there is the added challenge of duration, as the *Longplayer* composition, while there is a conceptual understanding that it is a loop, is perceptually limited when it comes to experiencing it as such [Cox, 2021]. *Longplayer* is a “*sonic exercise in ecological thinking*” [Christenhusz, 2021], with the listener able to experience a fraction of these large timescales.

Artworks such as *Unequal Hours* illustrate a kinaesthetic presentation of a temporal interdependence across species from small to large scales. Similarly, in *The Phenology Clock*, the temporal interdependence that we attune to is between the species, flora and fauna of a local place. This phenomenon can be seen between artefacts as well. As one user of *The Present* describes, *The Present - Day* and *The Present - Year* connect at a particular moment every day by pointing in the same direction, which in winter happens in the morning [The Present, 2023c]. This implies that there are also moments of difference, when the clock hands point in opposite directions. Similarly, the *Ever Blossoming Life Rock* installation in teamLab's exhibition contrasts the experience with the artwork, which is defined by a lived experience of temporality and the temporality of the boulder, which is timeless and marked by seasonal changes [Lee, 2022, p. 158]. The installation *Megaliths in the Bath House Ruins*, through the rectangular prism forms, warps space and time and showcases various patterns of continuity and change that reveal what has been forgotten or submerged. These space-times can intersect, overlap and be compressed.

6.2 Unmaking of the Singular

The theme of *the unmaking of the singular* is here analysed by looking at expressions of plurality in *materials, representation and experiences*. Pluralism deconstructs standard conventions by cultivating alternatives to normative discourses [Bardzell, 2010], which is critical in posthumanist thought and “*makes knowing expansive (or inclusionary) rather than exclusionary*” [Wakkary, 2020]. The artworks we analyse explore the many ecological realities imbued with plural temporal and spatial relations. They utilise a variety of materials that more heavily focus on the embodied experience with time and move away from conventional representations.

6.2.1 *Plurality in Materials.* The works present a great material variety in terms of tangible forms, such as the ribbons in *Unequal Hours*; digital forms, like the extensive data used in *The Room of Change*; and environmental aspects, such as the nature and ruins in a natural park in *A Forest Where Gods Live* and the various plant specimens pressed into powder form in *Allochronic Cycles*. Time-based media projects, such as *Pranatamangsa AR*, are notably valuable for representing abstract notions of time and environmental changes that are connected to different ecologies [Raupach, 2018a]. Additionally, *The Present* makes tangible the cyclical idea of time, which is often slippery, while the creation of *Longplayer* was instigated by the challenge of “*representing and understanding the fluidity and expansiveness of time*” [Longplayer, 2005]. *Longplayer* represents the idea of artificial life, as throughout the 1,000-year-long process, it “*would not only be a real living organism with a life and tradition all its own but one with a capacity to propel itself by its own momentum*” [Young and Zazeela, 2004, p. 16]. Similarly, the AI in *Allochronic Cycles* is considered a nonhuman agency that presents the possibility of symbiotic living between humans and nonhumans, thus envisioning a posthuman future [Ga, 2021]. The AI observes the various timescales and their interactions, potentially interrupting and resetting them [Cesar and Lois, 2021].

Environmental observations are increasingly technology mediated, as satellites, weather stations and data centres are replacing direct embodied engagements to understand and detect changes in the climate [Brain, 2017]. This development can be used as an opportunity to develop digital tools that shed light on the lives of other creatures [Smith et al., 2017]. Thus, more imaginative ways of communication are required, which is what *Pranatamangsa AR* aims to support. The animations used in the artwork can support the representation of abstract temporalities and the conceptualisation of time in relation to climate change [Raupach, 2018a]. AR, in this case, was used to “*disrupt the linear order of this work*” [Raupach, 2018a], as the participants could choose the order in which to read the prints. This reordering from the original timeline represents the unpredictability of environmental disruptions in the current state of climate change [Raupach,

2018b]. This combination of still and moving images through AR presents the multiple timescales entangled in climate change and the disruptions happening to familiar natural changes. As the components, i.e. the moving image, technology and physical objects, function on different timescales but co-exist in the same space and are experienced together, animation fuses the spatial barrier between these temporalities [Raupach, 2018a]. This allows a layered construction of time across multiple planes, with a particular negotiation between the various temporalities.

6.2.2 Plurality in Representation. Considering that the many natural processes related to climate, temperature, or biodiversity will function differently compared to what we currently expect, having artefacts that account for the changes sets an example for designing artefacts that are adaptable due to the unpredictability of the natural environment [Smith et al., 2017]. *The Phenology Clock* is such an example. As a data-driven artwork, it concentrates on a local scale, such as a city, focusing on the plant and animal species of the area. The artwork thus presents similar ideas to the field of collapse informatics [Tomlinson et al., 2013], which focuses on designing for scarcity by putting forth designs that are adaptive to the variability of various natural processes rather than implementing fixed designs. It invites participants to reflect on the natural patterns in their local environment rather than looking at the data retrospectively [Agapakis, 2015]. Having the artwork in a clock form, with a hand passing through the months, makes it much more dynamic than its rectangular, more static counterpart, *Keeping Time*.

Another aspect of adaptability is the many ways *the long term* is addressed and expressed. Artefacts such as *The Present* are constructed to continue displaying the yearly cycle for a long time [The Present, 2023a]. *The Room of Change* illustrates a sense of complexity and long-termism, with the represented data starting from 1,000 B.C. and ending in a speculative future (2,400) [Bradley, 2019]. Moreover, *Deep Time Walk* makes use of mobile media to create experiences that sustain an understanding of “*where we really are in time and space so that we can comprehend our future trajectory*” [Deep Time Walk C.I.C, 2017a]. Similarly, *Longplayer* prompts a reflection on the future and the permanence of humanity, culture and technology [Cox, 2021]. It has adaptability in mind, as it is composed in such a way as to be independent of any technological and social change. As a durational work, it raises questions about technological obsolescence, as the current technology that supports it will eventually have to be replaced [Martynski, 2021, p. 120]. With this in mind, the complementary app on which the musical composition can be listened to was also designed to be easily updated, which Finer refers to as “*the deep space mission approach: making something that needs minimum change over time to guarantee its survival*” [Bridle, 2015].

Other pieces take a more straightforward approach to representation. Many of the installations in teamLab’s exhibition revolve around creating unique shapes, lines and combinations, with an image of nature as “*ideal and simplified*” [Li, 2020, p. 78]. The installation *Universe of Water Particles on a Sacred Rock* is an example, taking inspiration from the belief that water has a purifying ability, as expressed in the indigenous religion Shintoism. The calming visual style is also the result of a collaboration with the contemporary Nihonga painter Hiroshi Senju, who depicts serene waterfalls inspired by traditional Shanshui and ukiyo-e masters [Li, 2020, p. 78]. Similarly, according to Thrift, timescales that follow seasonal, circadian and lunar rhythms are simplified and elementary representations of time, compared to the standardised units of time such as seconds, minutes and hours [Han, 2020]. Such a simplified view provides a calmer experience and gives the impression of having more time than a normal clock.

6.2.3 Plurality in Experiences. Some artworks engage with embodiments of space-time, such as moments being frozen in time. This concept of space-time is used in teamLab’s work to define the relationship between a space and its temporality. For example, the ruins in the Mifuneyama forest are its own space-time, and the bathhouse represents a place where “*time had stopped completely*”,

as it was abandoned shortly after being built [teamLab, 2019b]. *The Room of Change* engages with this idea by representing in its visualisation “*a snapshot of a precise moment frozen in time*” [Lupi, 2019]. Meanwhile, *The Present - Year* is the embodiment of a clock that seems to be standing still or where time seems to have stopped, as no movement or sound can be detected, refocusing our attention on the present. While these artworks present or engage with space-times that are standing still, users of *Deep Time Walk* can stop time by simply standing still. As the app uses the pedometer to trigger the narration, when the listener stops walking, the narration also stops, which creates a space-time of standing still. Additionally, each walk with *Deep Time Walk* creates its own space-time depending on where the participant was walking. This is an example of compressed space-time: the walk through the Earth’s history is reduced to 1 hour and 30 minutes.

This is followed by depictions of the slow flow of time in artworks such as *A Forest Where Gods Live*, in which the forest surrounding the Mifuneyama Rakuen Park changes slowly over the course of the year and then starts its cycle anew [teamLab, 2019a]. Similarly, *The Present* is an artwork that presents the value of slowness and is meant to help its users slow down [The Present, 2023b]. The gradual gradient enables this feeling of time slowly flowing, which a rigid calendar grid does not achieve [Drumm, 2016]. Moreover, in *The Present-Day*, the placement of the hand, compared to a usual clock, visually gives the sense of having more time, as the hand is placed only halfway when the standard clock shows 6 PM [Drumm, 2016]. As Thrift explains, when one is unable to track every moment that passes by through numbers, each moment is slowed down and perceived as if there is much more time left [Kushnick, 2016]. The artwork contrasts tools that value speed, efficiency and productivity by providing a slowing down of daily life. The changes in *The Present* are perceived quite similarly to how we perceive changes in nature, i.e., they are noticeable after some time, adding a *meditative simplicity* to the experience [m ss ng p eces, 2011]. With *Deep Time Walk*, walking is the practice that alters the sense of time, creating a slower and exposed experience of interacting with the environment [Martynski, 2021]. The slowness is also embedded in *Longplayer*, as it is similar to experiencing a slowly moving analogue clock [Cox, 2021].

Locative media offers many opportunities to build place-based experiences that are adaptable to the travelled distance and pace [Duggan and Goldschmidt Kiminami, 2021, p. 8]. As an entanglement between the narrative, environment and walker, *Deep Time Walk* embraces walking as an experience that “*folds body, self, other humans and nonhumans, time-space and place together*” [Edensor, 2010]. This work creates associations between the walk and deep time, as well as associations and attunement to the place in which one walks, imbuing the space with new meanings [Martynski, 2021, p. 141]. The work, on the one hand, aims to dismantle the human/nature dualism by emphasising the entanglement between human and geological time and multispecies entanglement [Haraway, 2016] in general. On the other hand, it aims to “*break the paradigm of an isolated and abstracted digital world*” [Deep Time Walk C.I.C, 2017a] by challenging the mind/body dualism and situating the “*body as a site of knowledge development*” [Martynski, 2021, p. 116]. This way of walking is *attentional*, focused on attuning and responding to the environment, rather than *intentional*, which happens when one is travelling from point A to point B [Ingold, 2015, p. 133].

Play is another experiential aspect specific to teamLab’s work. In installations such as *Resonating Mt. Mifuneyama* and *Life is Continuous Light*, play is shown in the presence of visitors by responding to their movements with light. When installations such as these are part of a specific natural site, rather than a museum or gallery, play takes a considerable role in creating “*more believable realities*” and a more holistic and complete exhibition [Li, 2020, p. 113]. All the different elements in the exhibition, both imagined and real, have a role in creating a more immersive and embodied experience in which play becomes part of the sensory sphere. Entangled in play are rituals, another important part of teamLab’s work, as both rituals and play have the capacity to transport people to another world [Huizinga, 1949, p. 18]. Various ceremonial aspects are embedded in the *A Forest*

Where Gods Live exhibition site, such as the sacred rock or the sacred site of the steep mountain of Mifuneyama.

6.3 Unmaking as Messing Up

This theme foregrounds the ‘mess’ of entanglements implicit within the artworks. Compared to the ‘clean’ and objective look of a standard clock, and although the projects also present a clean aesthetic, the underlying processes are messy, with the added complexity of interconnected temporalities that can be difficult to untangle. Entanglement as a concept within new materialism points towards how we are interdependent, through technology, ecosystems and other beings, and entangled in various complex relations. This indicates an absence of “*independent, self contained existence*”, as we materialise through and as part of this entanglement [Barad, 2007]. Artefacts also present *deep entanglements*, particularly in relation to their impact on future generations [Rahm-Skågeby and Rahm, 2022]. We here explore *unmaking as messing up* by describing how these artworks embody and present different connections, muddying the previously clean and ordered worldview. We thus engage in a process of untangling what has been weaved: we follow how various threads intertwine to understand the diverse aspects of their connections. Thus, we do not engage in absolute separation, material or otherwise, but conceptually unmake what is interconnected and typically unseen. In the following, we will focus specifically on untangling the connections in *knowledge, practice* and *more-than-human relations*.

6.3.1 Entanglements in Knowledge. The artworks engage with and draw from various disciplines to unpack the topic of time. Along with *The Present, Deep Time Walk* addresses “*temporal illiteracy*” [PSFK, 2013] by forming a better relationship with time and advancing not only an understanding of deep time but also a sense of *timefulness*, which implies knowing the history of the Earth and taking a geologist’s perspective on time—the perspective needed for moving towards sustainable futures [Bjørnerud, 2018]. *Deep Time Walk* draws from the teaching practices of the *Four Ways of Knowing* proposed by Jung [Jung, 2016, p. 401]: *sensation, feeling, intuition* and *thinking*. This methodology has contemplation as the main element that supports learning and building an ecological awareness [Deep Time Walk C.I.C, 2017b], illustrating how combining knowledge and creativity can lead to rethinking our place on Earth [Deep Time Walk C.I.C, 2017a]. The script of the audio narrative of *Deep Time Walk* is the result of a collaboration between science and humanities disciplines, represented by the scientist Dr Stephan Harding and the playwright Peter Oswald, respectively [Deep Time Walk C.I.C, 2022]. The narration follows the characters of the Fool and the Scientist as they embark on a journey to uncover the history of the Earth’s geological timeline. This form is used to mend the fragmentation between disciplines and forms of knowledge [Martynski, 2021, p. 116]. As a fusion of technology, science and poetry [Deep Time Walk C.I.C, 2017a], this work is intended as an interdisciplinary activity that can be used in an academic setting [Curi, 2017]. teamLab’s work also lies at the intersection of art, science, technology and the natural world, as they implement various collaborative practices [teamLab, 2023]. Cesar & Lois’s work is another example of transdisciplinary work that represents layers of timescales ranging from viruses and plant growth to the history of the universe. Lastly, *Allocronic Cycles* points to the creative potential of humans and nonhumans when they collectively work together and how this potential is valuable in imagining new posthuman worlds [Ga, 2021].

6.3.2 Entanglements in Practice. Artworks employ various practices for bridging the gap between virtual and natural environments. This is the case for *Pranatamangsa AR* and its use of seamful interfaces, which have a slight gap or mismatch between the physical space and the virtually created one [Chalmers and Galani, 2004]. As the inconsistencies between these spaces are evident, the AR is used to support viewers in moving between the various visual layers, allowing them to

“negotiate various rhythms and temporal scales” [Raupach, 2018a]. Navigating such a multilayered environment develops new behaviours and a new sense of self composited into the augmented world [Roquet, 2016]. Animation in the artwork is used to support experimentation with expressing, understanding and experiencing time. Animation is a collection of still images made frame-by-frame and viewed quickly in a series to give the impression of motion [Raupach, 2018a]. This characteristic allows one to explore the idea of change and the passage of time, and animation itself recollects how our understanding of time has changed throughout the years [Johnston, 2015, p. 227]. Raupach [2018a] explains that what differentiates animation from narrative-based moving images is that it creates a distinct sense of movement and, thus, an alternative engagement with time.

In the case of *Deep Time Walk*, the experience of walking through 4.6 billion years of Earth’s history is mediated through mobile technology. The app aims to shift focus from the smartphone screen to the natural world through an augmented audio narrative, rather than acting as a barrier to the natural world. In this context, this poses a challenge, as the technology meant to be in the background, e.g., in one’s pocket, creates a dependent experience with the phone, especially when various technological glitches occur; for example, one might check the phone when the narrative seemingly stops. However, the user can switch to Gaiaphonic Mode to make the sound play only on one earbud to listen to both the story and the surroundings while walking, which can help remedy this dependency. The space also influences the experience and can further distract from the narrative, making it difficult to refocus. Furthermore, another contradiction concerns how the app aims to bring us into communion with the natural world, with the experience often being isolated from others and individual in character. This raises concerns on how interconnectedness within nature can be developed under these circumstances [Martynski, 2021, p. 179].

A more seamless convergence of both natural and digital aspects is done in teamLab’s work, affording a “deep interpenetration of self, image, and world” [Lee, 2022, p. 153]. Removing the boundaries between virtual and real-world environments through **spatial augmented reality (SAR)** decentres the environment, erasing the bounds between visitors, the natural world and art. Additionally, this adds more layers to spatial perception, augmenting the idea of nature. Such an entanglement between the environment and the “digital handlings, visuals, sounds, touches and smells” [Li, 2020, p. 113] transforms nature into art. SAR is used in several installations within the exhibition *A Forest Where Gods Live* to support a more immersive and embodied experience for the visitors [Lee, 2022, p. 155]. Interactions with the visitors are seen in the form of flowers blooming when a visitor stands still in front of the installation or the flow of water being redirected in *Megaliths in the Bath House Ruins*. In the exhibition, visitors could be seen running wild in the forest, standing quietly and contemplatively, or touching the trees and flowers [Li, 2020, p. 76]. The interactive installations are also connected with each other and cause changes far away from the source. For example, the presence of people causes ripples of light in the forest through *Resonating Forest* and the neighbouring azaleas through *Life is Continuous Light*. In the *Resonating Mt. Mifuneyama* installation, the sound and light patterns travel various distances within the exhibition place, blending with the natural forms, such as the plants and mountains.

6.3.3 Entanglements in More-than-Human Relations. The artworks present the entanglements within the more-than-human in various ways. *Unequal Hours* physically represents the entanglements between human, nonhuman and technological timescales. For example, its menstrual cycle clock is connected to the clocks representing wages, referencing the gender pay gap [Mandryk, 2021]. *The Present*, with its three variations of time perception, builds on the aspect of connectedness with the world by presenting a holistic experience of a day, synchronisation with the moon and more extensively with the cosmos, and lastly, a built connection with the Earth and its

seasonal cycles. The piece allows for a shared experience and vision of time to manifest across every part of the Earth: when it is a full moon on *The Present - Moon* clock, it is so for every living being, which creates a form of multispecies entanglement. In like manner, *Allochronic Cycles* presents time as fragmented in contrasting, concentric circles based on different geological and biological processes, setting the boundaries for time and scale [Cesar and Lois, 2021]. While the artwork's name points to how we are disconnected from geological processes and timelines, it intends to synchronise us with other species and even broader planetary systems to become more-than-human.

Approaches in time representation such as *The Phenology Clock* and *Keeping Time* are considerably valuable at this stage of climate change, as they shift our focus towards understanding how natural systems work and contribute to a collective reimagining of our relationship with nature. They deal with the various reoccurring processes in animals and plants and are valuable in indicating how and which patterns of various species change due to environmental disruptions. This causes interrelated species to fall out of sync and endangers the entire ecosystem. Tega Brain gives the example of pollinators and the flowering cycle, which creates a temporal relationship that is based on synchronicity [Brain, 2013]. Cultural practices also depend on phenological patterns, such as the Tomatina festival in Valencia, Spain, exemplifying how nature and culture are connected [Brain, 2013].

As a multi-sensory immersive experience, *A Forest Where Gods Live* makes use of digital technology to blur the boundaries between the visitors, the built garden, and the forest and bring the focus to more-than-human interdependence [Lee, 2022, p. 162]. Considering that Mifuneyama Rakuen is a site with specific sacred associations, the exhibition visitors develop a connection with this aspect of the place and a sense of harmony with the natural world [Lee, 2022, p. 162]. teamLab's work can be considered a form of land art, as it creates relationality between the artworks and the landscape [Lee, 2022, p. 162].

Deep Time Walk has an important role in reconnecting us to the natural world by acknowledging that we are a part of nature itself and indicating how various natural forms, such as mountains and animals, are our ancestors [Opus Earth, 2016]. It supports an experience through which we, as participants, can understand the various geological processes that occurred to allow life to evolve up to this point, such as plate tectonics, the formation of oxygen-producing photosynthesis, or planet-wide temperature regulation. This project shows how everyone is entangled in deep time and the geological impact we are currently having [Deep Time Walk C.I.C, 2017b]. An aim of *Deep Time Walk* is for people to become what Jonas Salk calls “*good ancestors*”, meaning that they “*consider their decisions based on long-term, intergenerational justice*” [Deep Time Walk C.I.C, 2021a]. Similarly, *Longplayer* raises questions about stewardship [Martynski, 2021, p. 120]; in contrast to the various efforts towards making the work autonomous, Finer expresses how it has never been intended to be “*a self-sustaining sonic beacon ringing out to no one*” [La Frenais, 2019]. While the work could become autonomous, it should continue only if people want it to. It could be maintained generation after generation, with people continuously taking responsibility for it.

6.4 Unmaking the Other

Following the thematic of alternatives, we explore *the unmaking of the other* as unpacking the *other* world-making possibilities in addition to standard views, devices and expressions. The ‘other’ is imbued with an idea of being separate, disassociated and excluded. We notice the use of the *other* in posthumanist writing, such as the use of *other-than-human*, or when the dualism of self/other is challenged. Designing *otherwise* is increasingly being encouraged to challenge the conventional ways of designing by proposing different ways of affecting the world [Abdulla, 2018]

and designing with care [Helms, 2023]. We engage with *otherness* by conceptualising how the artworks successfully express *other perspectives*, use various tools *otherwise for dissemination*, and focus on *other living beings*.

6.4.1 Searching for New Perspectives. These artworks present new perspectives on time by stretching the conventional ideas of time that a normal clock provides. *Longplayer*, for example, takes a sonic approach to representing long-term periods of time, while *Pranatamangsa AR* uses animation to create possibilities for alternative imaginings to be combined with the natural environment. Raupach found the limitations in change and compressed temporality in animations indicative of the destabilisation of Pranatamangsa knowledge as it shifts due to environmental changes [Raupach, 2018a]. Similarly, *Keeping Time* aligns with ideas from design for reflection [Baumer et al., 2014], which aims to encourage users to reflect on a specific topic, which in this case is the social and cultural relations with and around different plant species.

Artworks such as *The Phenology Clock* also challenge traditional ideas of time. Although we follow the change in seasons and have calendars that reflect this, this is just a small part of the multiplicity of temporalities in the natural environment [Smith et al., 2017]. *The Present* aims to put things into perspective for those pressured by time, to change how time is experienced daily alongside the conventional clock used for scheduling. The three varieties of clocks represent a shift from an understanding of time as a commodity to an understanding that offers the possibility of becoming “*present, connected, and grounded in the world*” [The Present, 2023b]. Looking at the testimonials from users who have lived and experienced the artwork, they point to their new sense of scale, proportionality and perspective on time. One user explains this in the following way: “*Once one looks at something using a different paradigm, one does not conceive of it in the same way again. Ever. Open perception and you open possibility*” [The Present, 2023c].

Likewise, *Deep Time Walk* “*is an invitation to view the world differently*” [Deep Time Walk C.I.C, 2017a] by introducing opportunities for a better understanding of different worldviews and encouraging participants to find ways to put these into practice. The playwright Peter Oswald describes how, in the audio narrative, the Scientist character feels hopeless, as every action seems harmful to the environment [Deep Time Walk C.I.C, 2016]. Once she embarks on a journey with the character of the Fool, they start exploring a new perspective of the world and, thus, new alternatives. The narrative concludes with a mutual realisation that we have been entangled with each other, nature and the Earth since the beginning. The entire narration is a journey that starts with an opposing view from the Scientist of humans as sources of destruction and confusion about how we become human from the Fool and moves to realising that we have always been entangled at the end of the walk: “*If we wound you it is us that dies. There is no gap between us at all. We are the same thing.*” The choice to represent humans as merely a phase in the long life cycle of the Earth is a move away from an anthropocentric take described by the exploitation and instrumentalisation of nature. This work attempts to mitigate how “*the frictionless, atemporal instantaneity of digital communications weakens our grasp on the structure of time*” [Bjornerud, 2018, p. 164] by presenting an experience of deep time that brings us in tune with the rhythm of the Earth and provides an awareness of the human impact [Martynski, 2021, p. 115].

6.4.2 Searching for Disseminating Tools. In several of the artworks, information visualisation is the primary disseminating tool. *Keeping Time* presents its visualisation on a concentrated scale, as it focuses on a few plant species. However, it shows that while there are clear patterns in the data, the reasons behind those patterns are ambiguous. Visualisations like these need context and to be situated in both time and place to be understood. This artwork can be considered a data-driven design intervention that aims to represent how humans and environmental systems are interconnected. If they are seen and understood, visualisation projects can substantially impact

the public awareness of a subject matter [Valkanova et al., 2013], and they are important tools for bringing different issues into public discourse. Jeremijenko, one of the creators of *The Phenology Clock*, advocates for a transition from *data spectator*, in which viewers passively consume the visualisation without being able to question or challenge it, to *data contact sports*, where there is a more direct and interactive way to engage with and challenge the data [Agapakis, 2015]. In this regard, Smith et al. note the potential of *The Phenology Clock* in encouraging those interested in the natural world to explore nature in their local area and observe the various natural cycles and changes occurring within that space [Smith et al., 2017].

Artworks such as *The Phenology Clock*, *The Present* and *Deep Time Walk* sustain a diverse group of users who can engage with them. *The Phenology Clock* sets an example for further gathering data on natural systems and developing technologies that make these data accessible for those without advanced environmental scientific training, such as designers, who can further use the data and technologies in their own work [Smith et al., 2017]. *The Present* is aimed towards users across generations, while the creators of *Deep Time Walk* have made efforts to eliminate technological barriers, such as by making the app available on older smartphones and by releasing an audiobook version [Deep Time Walk C.I.C, 2022b]. They have made the app accessible by developing a Mobility-Assist mode, which can be used to listen to the narration without the need for walking [Deep Time Walk C.I.C, 2017b]. The user can also switch to Gaiaphonic Mode to make the sound play only on one earbud to listen to both the story and the surroundings while walking. Additional materials in the project allow the script of the narration to be read by those unable to listen to it and support facilitators who would like to organise a walk in their community [Deep Time Walk C.I.C, 2021b]. In this case, having the artwork in the form of mobile digital media is the factor that extends its scope, as it first removes geographical restrictions and the need for a guide or physical information boards [Martynski, 2021]. Second, as the app uses a recorded narrative that is played based on the walking pace and does not use a global positioning system or the internet, it provides a personalised experience, with the content being delivered at relevant points throughout the walk [Martynski, 2021].

In addition to the audio narrative, *Deep Time Walk* offers various resources, such as visual cards [Deep Time Walk C.I.C, 2022a]. At the end of the narration, the question ‘*What’s Next?*’ is presented. The suggested links are for those who want to learn more, connect with others and actively participate in taking positive action towards environmental change, specifically in their local area. The creators of this experience believe that through this temporal reorientation, the participants will be inspired to engage in positive action [Martynski, 2021, p. 115]. Given that the walk is intended to provoke an emotional reaction from the participants, it is an approach that is meant to provide hope and encourage them to take responsibility and act [Deep Time Walk C.I.C, 2018].

The use of animation, in *Pranatamangsa AR*, for example, is increasingly done in science communication to present complex phenomena and temporal processes or historical and future temporalities [Leslie and McKim, 2017, p. 208, 211]. Hand-drawn animations have been found to support personal engagement and, consequently, a better understanding of abstract concepts, such as long-term changes in the environment [Raupach, 2018a]. Emotion is an important aspect in this case, as it passes through the virtual and physical layers and weaves them together [Roquet, 2016, p. 240]. Considering that the emotional side of technologies such as these is critical, it presents a significant strategy for science communication that can be used to engage the public in supporting initiatives against climate change [Raupach, 2018a]. Each animated frame in *Pranatamangsa AR* is a compressed time period and, when these frames are put together, these various periods of time are distributed sequentially. These properties of compression and distribution are valuable for articulating the themes these animations address [Raupach, 2018a].

6.4.3 Searching for Signs of Life. Two artworks distinguish specific ideas on animacy. teamLab's work has multiple installations that portray nature as living through digital materials, such as *Universe of Water Particles on a Sacred Rock* [teamLab, 2017d], which is a mixed-reality installation that gives a sense of animacy to the rock, as if it has been "*woken up from a long sleep*" [Li, 2020, p. 71]. Similarly, in the *Resonating Mt. Mifuneyama* installation, the mountain is lit up and shines brightly; then slowly, the light fades, as if the mountain is breathing [teamLab, 2018]. As visitors move through the exhibition, many installations come to life and bring the various natural forms into focus [Lee, 2022, p. 155]. This exhibition can be said to follow a traditional Japanese belief that has existed at Mifuneyama for a long time, Shintoism, in which spirits or deities inhabit various natural forms such as mountains, trees, rivers and waterfalls [Li, 2020, p. 69]. Thus, the use of light in the installations is a reminder of this belief, enhancing the animacy of both the artwork and the natural form.

Similarly, *Deep Time Walk* supports the Gaia hypothesis, developed by James Lovelock [Lovelock 1972], which states that the Earth can be considered, in a certain way, alive due to the self-regulating feedback between various natural forms such as rocks, the atmosphere and water. These feedbacks point to how the Earth has remained suitable for life throughout geological time. Through this work, we are thus encouraged to develop a "*deep Gaia consciousness*" [Media, 2017], which involves seeing the Earth as a living organism; this is presented as a necessary step towards dealing with the environmental crisis. The app thus acts as a tool to remediate this disassociation between our "*animal body and the animate earth*" [Opus Earth, 2017]. There are many aspects in the design of *Deep Time Walk* that frame the Earth as a living organism, such as using expressions like "*living Earth*" and "*our planet evolved*", addressing the Earth as "*lady Gaia*", and using the pronoun she to personify the Earth [Stibbe, 2020, p. 200]. "*The Earth is you and you are the Earth*" is expressed during the narration, which builds towards a "*planetary ecological identity*" [Stibbe, 2020, p. 200] in which humans are part of the living organism called the Earth; this communicates that by harming this organism, we are harming ourselves.

These artworks contrast with investigations within HCI, which have primarily focused on human experiences separate from nature, as many environmental disruptions are too complex to be reduced to human frameworks of time, e.g., calendars and clocks. Once we step away from the dual representation of time as either objective or experiential, we can observe how other aspects of time take shape. This is pivotal within the artworks analysed, where extending the dimensions of time means moving beyond a techno-centric and anthropocentric perspective to one in which a multitude of timescales co-exist and interact, such as ecological and long-term timescales that include those of us in the now and future generations [Rahm-Skågeby and Rahm, 2022]. Taking such a stance with the concept of time deconstructs the notion of 'human exceptionalism' that further creates a gap between nature and culture, emphasising nonhumans' role and agency in building our worlds [Latimer and Miele, 2013].

Thus, rather than taking an apolitical stance, these projects follow a *temporal gaze* [Adam, 2000], i.e., they examine worlds through time and temporality in the context of environmental disruptions. Such an approach is fundamental for cultivating attunement to these changes and finding ways to prevent harmful occurrences through time, care and attention. Notions of time are, for instance, fundamental to experiences of breakdown, maintenance and repair and how these can help us rethink the relationship between technology and material contexts [Jackson, 2016].

7 Discussion

In the previous section, we presented how the ten artworks intervene in posthumanist discourses, specifically discussing unmaking normative constructions of time and aligning with ideas of pluralism, entanglement, and the 'other'. The variety in how these artworks have materially

presented more-than-human temporal reimaginings highlights the creative potential for further investigations of the posthuman discourse on time in HCI. This section will discuss the four conceptualisations of unmaking. We will also reflect on challenges and opportunities for HCI as it converges towards unmaking and the more-than-human.

7.1 The Turn Towards Unmaking

The ten artworks are, although they are fundamentally different in form, all concerned with changing perspectives, presenting new ideas and contrasting with the more romantic and nostalgic explorations of time in HCI [see Spence et al., 2022], as well as with more utilitarian investigations of usability and sustainability [e.g., Bowler et al., 2022; Rahm-Skågeby and Rahm, 2022]. They also seemed to dismiss existing or conventional representations of time in various ways, providing alternatives that include otherwise invisible temporalities. The interest in unpacking the topic of time aligns with increasing concerns about how environmental disruptions affect humans and natural ecosystems. This is a challenge for artists and interaction designers alike, but here we see how the artists have deemed it necessary to explore different strategies to construct temporal expressions. By rethinking the traditional ways of making time, the artists decentre the conventional human ways of knowing time, being in time and designing tools for making time.

In reference to categories defined by Sabie et al. [2022b], we view the artists' work as a blend between *unmaking as resistance* and *unmaking as material innovation*. All the selected media art projects resist the normative concepts of time, specifically clock time and human-centred temporalities. Their assortment of temporalities spans human to nonhuman living beings and technologies. They present novelty in their use of a variety of materials that are otherwise unusual for common time-telling devices: tangible materials, such as the ribbons in *Unequal Hours*; digital materials, such as the extensive data used in *The Room of Change*; the nature and ruins in a natural park in *A Forest Where Gods Live*; and various plant specimens pressed into powder form in *Allochronic Cycles*. Following the analysis, we conceptualised four individually distinct themes concerning how unmaking became delineated. The four themes were as follows: *dissecting temporality*, *the unmaking of the singular*, *unmaking as messing up* and *unmaking the other*. They follow a more relational reconstruction, in which standard tools and perceptions of time are positioned at a similar level to the alternatives rather than above all the alternatives. This approach aligns with posthuman thinking and the more-than-human turn in general, which presents a switch from a human-centred perspective to a relational perspective, where there is no centre [Liu, 2020; Poikolainen Rosén, 2022].

When the pluralistic qualities of time are neglected, this excludes “*certain practices, individuals, and natures, and supports the dominance of others*” [Pschetz, 2015]. In addition to representing timescales that are other-than-clock time, through the theme of *dissecting temporality*, we observed how these artworks exemplify various alternatives for engaging and unravelling other-than-human timescales. In tune with the proposal of *temporal design* [Pschetz and Bastian, 2018], the art cases recognised the value in exploring alternative temporalities, especially when approaching the complex challenge of climate change. On the path of deconstructing temporal multiplicity, these works expose how ‘the human’ is situated in a “*multispecies affair*” in which all creatures have a role in sustaining livability [Tsing, 2017]. They materially construct possibilities for understanding and viewing time differently to redirect the normative human-centred realities towards a considerate and thoughtful communion with nature.

The second theme of *unmaking the singular* embraces plurality, which implies that situated knowledge takes up space and that we do so from a certain standpoint when making knowledge. When multiple perspectives are combined, we reach a stronger understanding of the world. Transitioning from the singular to a plural perspective acknowledges a wide variety of similarly

valuable ways to examine reality. This aligns with the tension between *defuturing*, in which the modern unsustainability that shatters possible futures is considered, and *futuring*, which presents the possibility of having a plurality of futures, which Fry uses as an argument to move towards *sustainment* that would allow for these multiple futures, i.e., thinking, doing, being, to exist: “*while the planet is singular, world is plural—for it is formed and seen in difference—as are we*” [Fry, 2014]. More than that, we consider how the artworks, while they are different in various ways, are still connected in terms of materials, representation, or experience when engaging with pluralism, thus following Escobar’s concept of the pluriverse as a “*world where many worlds fit*” [Escobar, 2018]. Specifically, they possess the *fractal* quality of the pluriverse: “*anywhere you look at it, and at any scale, you find similar (yet not the same) configurations, meshes, assemblages … that is, the pluriverse*” [Escobar, 2018, p. 257].

For the theme of *unmaking as messing up*, we unravelled connections of knowledge, approaches, and relations of a more-than-human nature. We understand entanglements, as explained by Barad, as “*not intertwinings of separate entities, but rather irreducible relations of responsibility*” [Barad, 2010]. For example, while *Unequal Hours* materially entangles clocks, the temporalities embedded into each clock are dissimilar. The clocks that are connected to each other are entangled through relations of “*self*” and “*other*,” “*past*” and “*present*” and “*future*,” “*here*” and “*now*,” “*cause*” and “*effect*”” [Barad, 2010]. Some artworks presented a physical and tangible form of such entanglements. This was explicitly shown in *Unequal Hours*, with the physical tensions of ribbons representing the power of certain timescales over others. These also represented co-dependencies through the connections of clocks with the tangled ribbons. The possibility of the ribbons getting tangled to the extent that the clocks stop moving is analogous to how various environmental processes become disarranged by environmental disruptions. Other cases, such as *Deep Time Walk*, bound the entire experience with the artwork to show how these relationships and dependencies have been built.

The final theme of *unmaking the other* followed the understanding of entanglements from Barad, with ‘otherness’ understood as an “*entangled relation of difference*” [Barad, 2010], which points to how beings are distinct while remaining connected. We thus engaged with *unmaking the ‘other’* by presenting how seemingly separate perspectives, materials, and beings collectively create realities that are more than the sum of their parts. This aligns with Laurel’s proposals of “*Technology is not the other*” and “*Nature is not the other*” for a Gaian IxD based on a perspective that at every scale, the systems that sustain life, both biological and technological, are interrelated [Laurel, 2011].

While unmaking can be violent and destructive, we view the artworks as presenting a *gentle unmaking*: rather than removing, they question, dissect, and present alternatives. For example, in pieces such as *Unequal Hours*, *Allochronic Cycles*, *Pranatamangsa AR*, *Deep Time Walk*, and *The Room of Change*, human timescales are a component of the artwork; they are represented through clocks of the rhythms of the human body, the Anthropocene as a division of a disc, agricultural activities in ecological calendars, the time that Homo Sapiens has been on Earth, and society as a data visualisation topic, respectively. What is more, *The Present* is introduced as a ‘complementary addition’ to existing clock time artefacts rather than a replacement. For this reason, the works may initially seem apolitical, yet they appear to purposefully *muddy* the discourse on time. As we mentioned before, understandings of time, like clock time, are presented in a clean, objective, and *non-muddy* manner, detached from the material and experiential aspects of the world. Such a perspective is harmful, as it perpetuates possibilities that can only be perceived and understood through this singular lens. Despite the seemingly untroubled aesthetics of the artworks, they materially or conceptually engaged with the *muddiness* and *messiness* that result from unmaking. Materially, this is exemplified through embodied and immersive experiences like *Deep Time Walk* and *A Forest Where Gods Live* that call for engagement that is more unpredictable and unstructured, as the natural spaces affect the experience, or through the literal use of plant species turned to

powder to represent the “*dust of the cosmos*” for the disc presenting the cycle of the cosmos in *Allochronic Cycles*. Conceptually, the four themes indicate that the different forms of unmaking aim to muddle, entangle, and complicate within the more-than-human agenda.

7.2 Challenges and Opportunities for HCI

The two intersecting fields of HCI and media art are interdisciplinary and multidisciplinary and very much so by nature. Competing research interests often need to be “*backed by other subject specialist areas such as fine art, technology, anthropology, computing and economics*” [Dykes et al., 2009]. Each analysed artwork can be seen to represent a collaboration between the art, science, and technology disciplines. In this case, the fields are challenged by the “*translational*” work [Giannachi, 2012] needed to transfer the practice or concept from one discipline to another. According to Rapp et al. [2022], much of the work in HCI on time makes use of theoretical frameworks that originated in other fields, but the theory is either only partly applied or important insights are ‘lost’ during the transfer. Following the media art cases presented in this paper, we see how each work stems from a particular idea of time, with specific material expressions developing from there. This is perhaps most explicit in the naming of the artworks, e.g., *Allochronic Cycles*, *Unequal Hours*, *The Present*, *Deep Time Walk*, and *The Phenology Clock*. We see how further research could benefit from taking a diffractive [Barad, 2007] approach in which the theoretical starting point superimposes a collection of interactive designs, and by analysing its diversity, we can address the emerging patterns of difference [Britton et al., 2019].

Another notable aspect to those working in HCI is the development of a “*a posthumanist sensibility*” [Rahm-Skågeby and Rahm, 2022]. This argues for a move from the self to a collective experience and social and environmental commitments. The co-founder and executive director of *Deep Time Walk*, Robert Woodford, acknowledges that the individual character of the experience somewhat contradicts the long-term goal of the project [Martynski, 2021, p. 139]. Similarly, *The Present - Year* indicates a holistic view of time that aims to resemble changes determined by nature while also, through the embodiment of a clock, pointing to the individual in relation to the collective. Thus, this functioning artwork presented alternatives within the realm of time-keeping rather than explicitly focusing on social togetherness. The collective quality emerges when communities organise deep time walks or when *The Present* clocks stir conversations when they are noticed by others. *The Phenology Clock* is proposed to be introduced to communities as an activity to allow them to learn about their local urban species and attune to the temporalities within that place. From an HCI perspective, a reflection concerning this could be developing designs that inherently require a social aspect rather than being introduced to an existing community. Regarding the social as inherent to any interactive experience is thus an important reflection obtained from analysing these media artworks, which may also bring value to interaction design more broadly.

One particular connection to contemporary HCI discourse is how the works represent a transition from concern to action. Having a perspective different from human exceptionalism is associated with a relationship with the natural world that is less exploitative and instrumental. However, ecocriticism reminds us to be mindful that a reformed perspective is insufficient to drive action towards a more environmentally and socially just future or to adjust our ways of living to be more in tune with nature [Clark, 2015, p. 18]. Nevertheless, we unpacked how the artworks supported beliefs in various ways. In addition to providing a rethinking of time, the pieces pointed towards nature-culture interdependencies in *Keeping Time*, local natural patterns in *The Phenology Clock*, the various entanglements between humans and their natural environments in *The Room of Change*, and connections of the past, present, and future between human and geological timescales in *Deep Time Walk*. Furthermore, *Deep Time Walk* used a creative approach to present how we are all “*part of a wider web of sacred life*”, seeing the Earth as an extension of our bodies with whom we

symbiotically cohabitate [Mowe, 2017] rather than a suggestion of human exceptionalism [Deep Time Walk C.I.C, 2018].

While designs that support reflection and change our self-understanding as agents are relevant, there is a need for designs that can shift our behaviour and how we interact with the world in practice. One way to do this is through roadmaps that provide instructions on how to take action, as in *Deep Time Walk*'s 'What's Next?' Another strategy is that of *transitional arts practice* [Neal, 2016], which is built on "*the experience of artistic practice in the context of current global challenges, to make collective space to create a new narrative of change*"; this could take the form of designed tools and other resources. This is thus an opportunity to create geographically specific and culturally nuanced designs. For example, *The Present - Year* could be personalised to the characteristics of the seasons in a specific part of the world, considering that many 'deviations' from the standard 'four seasons' exist. Designs can also include functionalities that connect people to their local groups, such as in *Deep Time Walk*; with these groups, they can access tools and resources to act and apply unharful practices. To support networks and relations on broader and global levels, these designs could also include options for sharing, such as taking a walk through deep time with a far-away friend, following the phenology clock of your native land, or creating physical entanglements of the human and nonhuman temporalities that we encounter throughout our lives. Other alternatives could be creating discursive objects meant to be experienced with others, whether this occurs in an exhibition setting or in other types of locations.

Unlocking the creative potential through artistic practice is currently linked to "*reconnecting with our deep nature of creative beings by urgency*" [Deep Time Walk C.I.C, 2017a]. Taking creative pathways allows various dialogues to take place and, as a result, become a site of transformation [Martynski, 2021, p. 179]. This creative engagement with challenges, such as the impact of the Anthropocene on the Earth, contrasts with more didactic approaches that focus on teaching and persuasion, which have been shown to have a low effect in terms of engaging or moving audiences [Crossick and Kasznska, 2016, p. 65]. Considering that through imagination, we can envision possible futures and find ways to make these futures happen, the ideas and stories disseminated in relation to climate change affect how we approach this challenge. Various media can be used to give form to and creatively tell a story. This brings opportunities to uncover abstract notions of time that are usually left undetected but are nevertheless essential to understand. This is the case when one uses the type of technology that helps bridge the gap between virtual and natural environments and supports a more immersive experience for the visitors [Lee, 2022, p. 155], as in *A Forest Where Gods Live*. With virtual environments becoming increasingly realistic, the embodied interaction can further impact and shape the experience [Li, 2020, p. 79]. In combination with specific events/stories, it is also a great example of connecting bigger and smaller dimensions for us to relate to each other. The concept of an 'art exhibition' is also an exciting example of embodied interaction, especially in mixed-reality environments in which "*the sensual qualities of a real nature and the steerable ones of a digitized nature*" are simultaneously present [Li, 2020, p. 79]. Animation can also draw attention to the "*unpredictable and unobservable aspects of environmental change that is spatially and temporally distant from everyday life*" [Raupach, 2018a], as in *Pranatamangsa AR*. As it brings out these alternative temporalities and clears certain abstract notions of time, it becomes a relevant tool for various scientific disciplines that require forms of representing change and transformation, e.g., climate science [Society for Animation Studies Conference, 2018, p. 112].

8 Conclusions

We have presented an analysis of a selection of ten media artworks concerned with the unmaking or deconstruction of established notions of time and temporality. The artworks are analysed in alignment with contemporary theories in posthuman discourses, highlighting their explicit engagement

with notions of plurality, entanglement, bodies, and materiality. We conceptualised four themes through which unmaking was represented in these contexts: *dissecting temporality*, *the unmaking of the singular*, *unmaking as messing up*, and *unmaking the other*. We see several implications or ways that this analysis could inspire interaction designers. First, transitioning from the singular perspective to a plural perspective of time acknowledges a wide diversity of ways to examine reality beyond what is standard or provided in a given material context, welcoming alternatives suited for specific places, uses, or cultures. Second, entanglement points to time as relational, social, and interconnected, a perspective from which many promising design projects could evolve. Third, presenting how seemingly separate perspectives, doings, and beings collectively create realities opens up broader notions of what or who is included as a user or actor in a designed system. Finally, the analysis emphasises how the artworks materially illustrate possibilities for understanding and viewing time differently, thereby deconstructing established forms of representing temporality. However, rather than being violent and destructive or fundamentally disrupting existing systems or representational forms, the selected artworks represented a *gentle unmaking*, focusing on adding, questioning, or presenting alternatives. Nevertheless, as with the process of unmaking, an inevitable deliberate and desired mess happens as a result. Considering how unmaking aims to muddle binaries and harmful standards within the posthuman discord, the selected artworks aim to do the same. They purposefully make a mess out of the clear and structured world created by clock time, with the four themes representing how unmaking emerges. We thus see several opportunities for HCI based on the above study, in terms of both concrete design inspiration and theoretical implications. We derive from the media artworks theoretical beginnings that are different from the norm, i.e. phenology instead of clock time, that generate an array of designs that can provide the alternatives called for to further advance HCI work on time and posthumanism. These alternatives should be situated in time and place, include practices that do not harm nature, support immersive experiences, and connect users to local groups where the work can be further developed. Challenges remain regarding how to bring forth inherent social qualities, focus more on the collective than on the individual, and shift from concern to action.

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