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Temporal awareness and ethical reflection: Chronopolitical considerations for HCI research

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Abstract

HCI increasingly engages with the concept of time, with many studies focusing on how temporal relations are produced and reconfigured through computing technologies. However, less attention is paid to the impact of temporality on researchers themselves and specifically their capacity for ethical reflection and action. This paper explores the interplay between temporal features and ethical reflection in HCI research projects. Through a reflective multi-ethnography of nine research projects, we examine how temporal features can influence ethical capacity across the lifecycle of research. The study employs infrastructural and chronopolitical analysis (after Star and Sharma) and offers a range of considerations for researchers to help activate greater temporal awareness for everyday wisdom, to acknowledge temporal power, mobilise responsibility, counter isolation in interdisciplinarity, and promote collective action and dynamic methodologies for temporal research. The study responds to calls for more ethnographic approaches to temporality that address specific HCI needs and focus on practice.

CCS Concepts

• **Human-centered computing**; • **Human computer interaction (HCI)**; • **HCI theory, concepts and models**; • **High Relevance**; • **Interaction design**; • **Interaction design theory, concepts and paradigms**; • **Medium Relevance**; • **Empirical studies in interaction design**;

Keywords

Ethics, Temporality, Auto-ethnography, Multi-ethnography, Infrastructural studies, Chronopolitics, Ethical reflection

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1 Introduction

Time and temporality are of growing interest in HCI [1, 74, 75] with recent work examining how time has been explored in HCI from a variety of perspectives, such as how time relates to research methods in HCI [104], or to the objects of research [105], how design can influence the experience of time during digital interaction [75] and how research drives speculation and exploration of potential futures [2, 28, 73, 92]. Related work examines how temporal relations are produced and reconfigured through emerging computing technologies [52] and how technology embeds temporal values



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that structure everyday life [100–102]. However, there has been less attention paid to the interplay of temporality and the lived experience of HCI researchers, and specifically their capacity for ethical reflection and action. Some studies address broad issues with implications for ethics, such as the prospects of slow technology [40, 68] and slow computing [53] for challenging cultures of speed and acceleration in technology research. More recently, studies have drawn attention to the need for concepts, methods and an agenda for temporal research in HCI [49, 67, 91] and for more 'honest reporting of time and temporal constraints' in HCI research [44].

We contribute to this rich field of inquiry with an examination of the subjective encounter of time in relation to ethical reflection as experienced by researchers working in HCI. Through a multi-ethnographic analysis process, we make visible researchers' experiences of temporal norms and practices that create tension around ethical issues in HCI research. Our study responds to calls for further research in HCI on how time and technology interact and studies that use analytical and ethnographic approaches that focus on practice, and theoretical work motivated by specific HCI needs [67, 74]. It also addresses the need to cultivate temporal attention in order to develop 'ethically informed temporal practices in participatory research' [31, p.196].

HCI studies have for some time acknowledged that temporal factors have implications for ethical design. Research ethics guidelines and formal approval procedures, which establish an ethical position at a particularly early and static point in time, are recognised to be at odds with the dynamic and situational nature of research as it unfolds [61] and provide little support when further ethical issues arise [8]. This inflexibility is exacerbated by pressure for speed in innovation and outputs, which makes 'a slower, values-oriented design process unattractive' [88, p.379]. Many ethical risks associated with digital technologies can be identified with the rush to deployment where the capacity to engage in ethical decision-making can be severely constrained by tensions with business goals or roles within enterprise hierarchies [66]. This results in highly predictable and avoidable harms from digital applications such as autonomy violations, privacy invasions, deceptive design patterns, damage to integrity and well-being, discrimination and injustice, amplification of societal division and so on [6, 66]. Temporality is regarded as one of the key challenges for responsible research and innovation (RRI) [39], and in its connection to power it performs a distinct role in argumentation and decision making [46]. Yet the subjective experience of temporality in research infrastructures remains underexplored.

This study is situated within the growing area of first-person methods in HCI [23, 44] where researchers acknowledge their own positionality in research and design, and rely on first-hand experience as a mode of knowing and learning. It builds on studies that recognise ethics engagement as embedded in individual research processing [95], acknowledge the impact of affective experience and power [17, 29, 82], and the rich body of work in HCI that draws on the idea of infrastructure as relational [93, 94], and therefore subjectively important [55]. Drawing on Howell et al's [44] trioethnography approach, we employ a retrospective multi-ethnography (of nine research projects), involving reflection and dialogue to critically reflect on our own research as a means to investigate ethical tensions that relate to temporal infrastructure that enables or constrains ethical action. This process includes asynchronous and synchronous workshops and dialogues that explore separate individual research experiences in depth and juxtaposes them to highlight common challenges and draw out opportunities for ethical consideration in research. Our analysis draws on Star's [93] nine features of infrastructure, to reflect on how temporalities shape and inform research and ethical encounters in HCI and Sharma's [86, 87] concept of chronopolitics to examine where time is organized, valued, and unevenly distributed to sustain power relations. The discussion describes the infrastructural and chronopolitical features of temporality in HCI research and their interplay with ethics in practice, and offers four considerations for temporally aware research: a) Make temporal norms visible; b) Mobilise the responsibility that comes with temporal empowerment; c) Attend to the dynamic nature of ethical reflection; and d) Promote collective action for ethical HCI research.

This work demonstrates a range of approaches to thinking about ethics and time which coalesce on a shared challenge: that HCI design processes and methods for reflection and action need to account for the influence of temporal features on the choices and decisions available to HCI designers and researchers. Awareness of temporality and its impact in research practice, can foster more ethically robust HCI research.

2 Relevant Work and Concepts

Time and temporality are related concepts with an extensive literature across many disciplines of influence in HCI, including sociology, geography, social psychology, physics and so on [31, 52, 56, 65, 80, 100]. Conceptualisations of time and temporalities are varied but not consistently applied throughout HCI and so we present what is considered the most relevant work for our study. We first examine how time and temporality are defined and have been addressed and used in HCI research, and also articulate their connection to studies on support for ethical reflection and responsible action. We then introduce the key concepts of chronopolitics and infrastructure studies that we draw on and implement in our multi-ethnographic methods and analysis.

2.1 Time, temporality and ethics in HCI

The concept of 'time' is often understood to be universal and objective, quantitatively measured and often represented by clock time [65, 75, 80], whereas 'temporality' is understood as socially produced, experienced and perceived [31, 37, 52, 103] and where multiple processes and experiences overlap in a plurality of co-existing, interwoven temporal frames [31, 67]. In their metasynthesis analysis of time and temporality in HCI, Wiberg and Stolterman [105] suggest that HCI research sees 'time' as a design material whereas 'temporality' is a methodological approach and theoretical lens. Research on both is delineated by their objects of study - humans, computers, interaction and phases (over time) - as well as the micro-meso- and macro-perspectives on the field.

Microperspectives explore the individual's experience and sense of timing and pace, for example how users perceive time visualisations [24, 110] or how factors such as delay, expectation and duration impact on technology interaction [45, 75, 98] or on technology

acceptance [63]. Mesoperspectives explore speed and acceleration in work and life as well as the temporal precarity enabled by dynamic interaction between groups and systems [33, 54]. For example, many studies on collaborative settings in the CSCW community have looked at temporality in group work, such as how it generates 'collaborative rhythms' which are organisational, infrastructural, biographical, and phenomenal [47]. More recent studies describe the 'attunement' work required to synchronise and make dissonant rhythms within groups more manageable and reasonable [95]. A large body of work on temporal alignment emerged especially during COVID-19, and examined temporality for specific groups such as research participants, farmers, medical professionals, distributed team workers, gig workers and so on [13, 14, 50, 64]. Recent work has explored posthumanist approaches to understanding time through artefacts and artworks in HCI [7, 20] and has even begun to explore temporal aspects of human-AI collaboration [76]. But there remains little focus on groups of HCI researchers exploring temporalities among themselves. Meanwhile, macro perspectives observe the larger trends, waves and paradigms of research within HCI over time [11], emphasising the importance of historicity [12] as well as speculation and futuring in design [2, 28, 90]. The current wave in HCI has been described as 'entanglement' [33] which stems from the need in HCI to address 'accountability, responsibility and ethics' [ibid, p.22] with a greater focus on practice.

Several HCI studies offer useful methodologies and activities to visualise and support critical ethical reflection in research, including 'timelines' for design [107], ethics 'pathways' [17], ecologically resonant practice methods [38] and critical analysis of AI ethics toolkits [108], all towards supporting the *performance* of research practice. These studies are part of a larger shift towards centering ethical reflection in HCI, where the last two decades have seen a significant increase in work that directly addresses ethics in design and research [66]. Studies have proposed a range of critical and applied ethics theories and frameworks to assist researchers and elicit ethical reflection such as value sensitive design [34], action research [30], values levers [88] and virtue ethics [5]. Macro ethical approaches include calls for slow technology [40, 68, 69], slow computing [53], positive computing [16] and responsible engineering and design [9, 57, 78]. The latter can be viewed as part of a wider emphasis (in the EU at least) on responsible research and innovation (RRI) in technology research [39, 92], although studies also identify a growing gap between discourses on ethical research and the reality of experiences on the ground [51, 106].

Despite the diversity and proliferation of methods and theory, HCI researchers still grapple with understanding which ethical approaches to use, and when to apply them effectively [66]. Alongside this is a growing recognition that ethical reflection needs to happen not just at the outset of research planning and conceptualisation [ibid], or with the assistance of toolkits during research project timelines, but needs to endure and evolve through deployment and use (or non-use) of applications [43], and to remain vigilant over long term impacts [49]. This indicates that ethics is dynamic and entangled throughout and beyond HCI research and design processes [33, 61]. In response, calls for a 'temporal ethics' [52] suggest the potential of an ethics of refusal, of deceleration, of forgetting and other concepts related to slow computing [53] and the design philosophy of 'slow technology' [40, 69], which emphasise the embodied impacts and 'algo-rhythms' [21, 59] of accelerationist norms embedded in technologies through design processes and priorities that privilege speed [41, 100]. Some studies explore reflections on how defamiliarisation brings into focus the impact of acceleration more broadly on HCI research [85], and influential contributions from outside HCI explore how 'slow' values conflict with the neoliberal demands of 'fast' university research culture [10, 60, 62]. But again, there is little exploration of how such temporal processes specifically impact HCI research and researchers and their capacity for ethical reflection and action.

Across different strands of HCI and related fields, research methods themselves can be characterised temporally either as fast (rapid iteration and prototyping, user testing and progress, achievement and action) or slow (concerned with wicked problems, analytical and reflective) [104]. According to Wiberg [ibid], the irony may be that the design challenges for HCI are huge, global and long term and yet we are running out of 'time' to address them. Notably, a recurring theme among the studies outlined here is how frequently this work uses the extended temporal space created by conference workshops, to reflect on temporality and how research infrastructure supports certain temporal norms [e.g. 60]. Indeed, a significant strand of scholarly activity on time and temporality in HCI takes place in and is published from scholarly workshops, which offer the time to collaboratively explore issues such as: temporality and AI [19], a taxonomy of temporality [91], time and ethical capacity in research [49], more-than-human temporalities [70], making time for ethics in everyday practice [6], a design agenda for time, temporality and slowness [67] and many more. Workshops offer a moment in time when researchers across different temporal stages can come together to reflect, and act. They represent a space where the ordinary rhythm of HCI work is suspended for a time - but which is still constrained by research infrastructure. In the next section we explore the role of infrastructure more broadly and its relationship with power and temporality.

2.2 Temporal Power – Chronopolitics and Infrastructure

Before we explore the research experience of HCI researchers, we first introduce the key theories informing our approach to this study which support our understanding of how temporal power is infrastructurally distributed and experienced. Infrastructures are often understood as the 'large-scale things' that support daily life, like transport systems or the energy grid, or in this instance, the research infrastructure that supports HCI research [93]. However, Star & Ruhleder [94] argue that infrastructure is never just a thing, but is always relational and human and can be problematic, thus requiring 'infrastructural inversion' to bring to the surface and expose its workings [83, 94]. For this reason, infrastructural inversion is increasingly recognised for its conceptual and generative design potential [89].

Star [93] uses ethnography to explore the opaque structures and practices we take for granted and accept, and identifies nine characteristics of infrastructure: 1) it is embedded within a context; 2) it is transparent to use; 3) it is invisible/taken-for-granted until breakdown; 4) it has scope beyond a single event or site; 5) it is

built on and enabled by earlier things and practices (the 'installed base'); 6) it plugs into other infrastructures in standardised ways; 7) it is both shaped by and shapes conventions of practice; 8) it is always learned as part of membership (i.e. infrastructure is not the same for everyone); 9) it is fixed in modular increments, rather than all at once. All of these elements are temporal, in that time is standardised through infrastructure, and infrastructures privilege certain temporalities over others. They are also recognisable in temporal research norms and practices. Star and Ruhleder [94] move beyond seeing infrastructure as just materiality and they also consider socio-cultural and (temporal) norms, context and practices. Rather than asking *what* is infrastructure, they pose the questions of *when* is infrastructure, and *for whom.* Seberger and Bowker [83] note that infrastructure – and by implication temporalities – can become visible to users through experiences of incongruence between functionalities and user needs. They describe this kind of infrastructural inversion as the defamiliarisation that happens through dissonance, such as making visible the workings (or failures) of infrastructure. In our analysis, we use infrastructural inversion as a means to explore what is taken for granted or overlooked in research projects, and how our practices, and the ethical tensions we encounter through them, are temporally experienced through breakdown.

Meanwhile, Sharma's [86] concept of chronopolitics - the politics of time - helps to explain our multiple and diverse experiences of temporality and how they are imbued with power. Sharma is interested not just in the accelerationism which contemporary technologies enable, but the explanatory power of speed which is increasingly responsible for the production of new social realities experienced at the level of time [ibid]. Most of us do not experience a shared sense of time but rather 'a looming temporal order… producing new forms of temporal inequity' [87], which is held intact by the structural demand that one must recalibrate, or learn how to deal with time. In this study, we are interested in understanding how temporal power operates within HCI research processes, how we recalibrate and the impact of this on ethical reflection and action.

Temporal infrastructure is considered to be based on values of modernity and neoliberalism, which privilege progress, efficiency and profit [1] as well as linearity and speed [72]. As noted earlier, slow scholarship is in conflict with contemporary research culture, where speed appears central to the neoliberal academy [60, 99]. Current discourses on university temporality are dominated by chronopolitics and contend that there is little time for thinking and 'no time to pause for thought' [62]. Such temporal orders are also evident where some individuals are expected to be on call, whilst others are protected by fixed schedules [15]. However, critiques of distributional temporal accounts reject the idea that time poverty is the core phenomenon, asserting that time is structured [87] and often takes the form of 'temporal arbitrage' [18]. This structure operates when the temporalities of one group dictate those of others, and power and profit or benefits are generated by redistributing temporal burdens – waiting, urgency, and flexibility – onto less powerful people [ibid] even across generations [96]. This concept is endemic in the design of platforms, the gig economy, and digital labour more broadly [18]. However, temporal power is not entirely immutable. Resistance, refusal, subversion, and the ability to control one's own time (which we acknowledge is also guided by temporal power), offer pathways for challenging more oppressive temporal regimes [25, 30, 60]. These dynamics are critical to understanding the lived temporalities shaped by gender, class, and ethnicity, which inform distinct experiences of time and its ethical implications, including in research contexts [15].

Sociologists of time have described the particular role of universities as 'temporal arbitrageurs', translating long term concerns into short term priorities [97]. Elsewhere, scholarly inquiry is seen to be in a state of 'limitlessness…mediating between pasts, presents and futures' [32]. Infrastructural analyses of research practice produce diverging views which argue for a refusal of temporal order and the value of 'stepping out of time' [ibid] in research. Entanglement and temporality is also relevant in critiques of 'futuring', particularly given concerns for the 'missing masses whom critical designers do not address' but whose labour produces and services technologies [111]. This draws attention to the relationship between temporality and intersectionality, again raising questions over whose temporality and whose future matters. In response, scholars argue for greater attention to 'existential time' (that is, time that is socially produced and historically contingent, through our collective actions) in HCI, as something that design produces and, from an ethical stance, should be produced more consciously and reflexively [1]. This question has already been posed by communities engaged in HCI projects on the infrastructural edges, who are deeply aware of how technology can support versions of time that do not align with their realities [72, 77, 84]. However, researchers rarely have the time to question how temporalities impact on research, design and ethics. The research process presents an important site where temporality is constructed and concretised in design, shaping user interactions, and is therefore world-making and ethically important [71]. These chronopolitical and infrastructural concerns are inherent to HCI research but need to be made visible. Researchers embody these concerns and engage in temporal arbitrage, both individually and collectively, and so research practice is the appropriate context to begin exploration.

3 Multi-ethnography Method

First person reflexive methods are a growing area in HCI and related research fields, and are recognised for their importance in critical reflection on design and research processes as well as interdisciplinary academic and industry experiences [23, 27, 29, 44]. Ethnographic methods value the first-person experience and have been central to studies exploring infrastructure [93]. Related methods of duo- and trio-ethnography emphasise the dialogical relationship between lived experiences, by juxtaposing voices and incorporating methods of shared reflection and analysis [44, 81]. Our retrospective multi-ethnography (involving nine researchers) follows a similar route to explore the experience of temporal tensions and their impact on capacity for ethical reflection and action in different HCI research projects. Like duo- and trio-ethnography, our multi-ethnographic method positions the researchers as central research participants, recognising the value of dialogic encounters with others to produce insights, learning and possibilities for change [58].

This study has its origins at an in-person workshop held in 2024 [49], which provided a space for HCI researchers to reflect on the timelines that govern their work and to explore where and how

Table 1: Participants and projects in multi-ethnography reflection process

No	Role	Years in Research	Project example	Ethical Issues
P1	Lecturer: Socially engaged art in design & rural HCI/CSCW	9	Qualitative socially engaged art project designing participatory activities with marginalised teenagers towards alternative possibilities for community life	Expectations and capacity challenges between community and academic work; managing community and interpersonal tensions; challenging consensus on aims and outputs of community projects
P2	PhD candidate: HCI and Mobile Crowdsensing	7	HCI and Mobile Crowdsensing project reviewing use of GenAI and human-AI assemblages in community and culturally specific healthcare	Lack of acceptance of AI among target community; concerns about social safety, cultural intellectual property; assumptions about community consensus vs. representation; AI literacy and hesitation
P3	Research Fellow: Responsible software engineering	18	Responsible software engineering project examining freelance developers' attitudes to and experience with software security	Tensions for participants between client/product, career/earning and software security requirements; compromises in engaging in research; freelance platform design constraints on participation.
P4	Lecturer: Rural HCI, Applied Social Studies	12	Participatory innovation project that sought to scale a community technology based on the needs of small rural communities across Europe	Conflicting community needs and developer goals; technology as community investment in place vs. development investment in product; Precarity of community funding, short term research engagement; Research refusal among participants
P5	Research Fellow: Critical Data Studies	7	Collaborative industry-led project with multinational ICT company, city authorities and a national technology research centre on use of physical city assets to host IoT technologies	Differences between commercial and public values; challenges between collaborative practices, institutional barriers and urban governance norms; design driving competition between public realm and private profit
P6	Associate Professor: Ethics & HCI Design	16	International collaboration involving universities, national public health service and a multinational ICT research organisation, designing and evaluating mobile apps to support wellbeing during health and life related events	Competing input from different clinical/community experts; institutional expertise and power dynamics; challenges with access to target participants and incompatible alignment of research timelines and participant life events
P7	Design Researcher: Healthcare Design	5	Healthcare design project co-funded by private company, aim to develop a technological intervention to increase user engagement with the company's product	Potential conflict between user needs/analysis and company/product aims; tensions between design for engagement and design for wellbeing
P8	Asst Professor: Technology for Health and Care	8	Technology health and care study conducted in clinical settings to evaluate a smartwatch intervention within an online therapy programme	Research in collaboration with industry partners whose priorities may differ from academic objectives; Managing participant expectations in an RCT setting, particularly those assigned to the control group.
P9	PhD candidate: HCI Design	3	Trustworthy AI recommender systems project including a participatory design study with stakeholder groups in context of new EU Digital Services Act	Diverse aims and objectives arising from multiple funder needs and subprojects within a broader initiative; Competing priorities and obscured timelines.

Table 2: Reflective questions on temporal features of research experiences

Temporal Features	Reflective questions on ethical tensions
1. Encountering ethical tensions:	When did you first notice an ethical tension in the project? Was it clear from the start, or did it emerge over time?
2. Noticing temporal norms:	Was the tension shaped by factors that were already in place before the project began, such as time-based expectations or routines? Are those factors/norms established conventions within your field or research community?
3. Timing and influences:	Was there a specific moment or event that seemed to increase or shift the tension? Did invisible time norms become visible to you? How did these time structures influence your work, if at all?
4. Pace:	Were some parts of the project moving faster than others? How did this affect the way tensions were addressed? Did it feel like the tension built up gradually or appeared suddenly?
5. Scope:	How did the size or scope of the project affect the way time and ethical challenges were managed? Did working on different parts of the project require different approaches to time and urgency?
6. Response and Adjustment:	How did you or the team respond to these tensions? Did you or colleagues try to challenge established conventions? If this did not happen - and getting into blue sky thinking – how could you have "fixed" the situation? What would need to change?

ethical issues arise, and how chronopolitical and infrastructural elements of research enable and constrain ethical reflection and action. Participants in the workshop submitted descriptions of ethical dilemmas or tensions that they had experienced in previous projects and were then introduced to creative and systems-thinking tools to reflect on these situations as well as the power dynamics and temporal hierarchies that can constrain or accelerate ethical decision making. Participants included researchers with various levels of seniority, situated in different contexts geographically and on projects that differed by domain and variety of stakeholders. Following the workshop, a subset of nine participants and organisers continued the conversation and embarked on a structured process of multi-ethnographic narrative reflection, aimed at identifying connections between specific temporal features and norms of research, and capacity to address ethical challenges that arise. To provide context for the analysis, we outline brief descriptions of the participants, projects and ethical issues arising in Table 1.

The first stage in the multi-ethnography process involved devising a series of questions to guide the creation of reflexive narratives of a research project, based on the temporal and power chronography features outlined earlier. We adapted the nine elements of infrastructure identified in Star [93] into six temporal features to guide questions on: Encountering tensions; Temporal Norms; Timing; Pace; Scope and Response (see Table 2). The reflexive narratives were facilitated and captured using a Miro board (as both a synchronous workshop co-location and an asynchronous tool) where participants contributed subjective recollections on their own project tensions while observing and annotating the contributions of others (see Fig 1). The second stage involved synchronous online meetings, where researchers discussed commonalities, differences and patterns across experiences as captured in the process. Each researcher reviewed the collective content and independently conducted further analysis, identifying prevalent temporal norms and conventions as well as ethical implications across all contributions, recorded in annotations and comments. These findings are reported in Section 4 and include quotes and excerpts reflecting original project descriptions and later reflections and analysis.

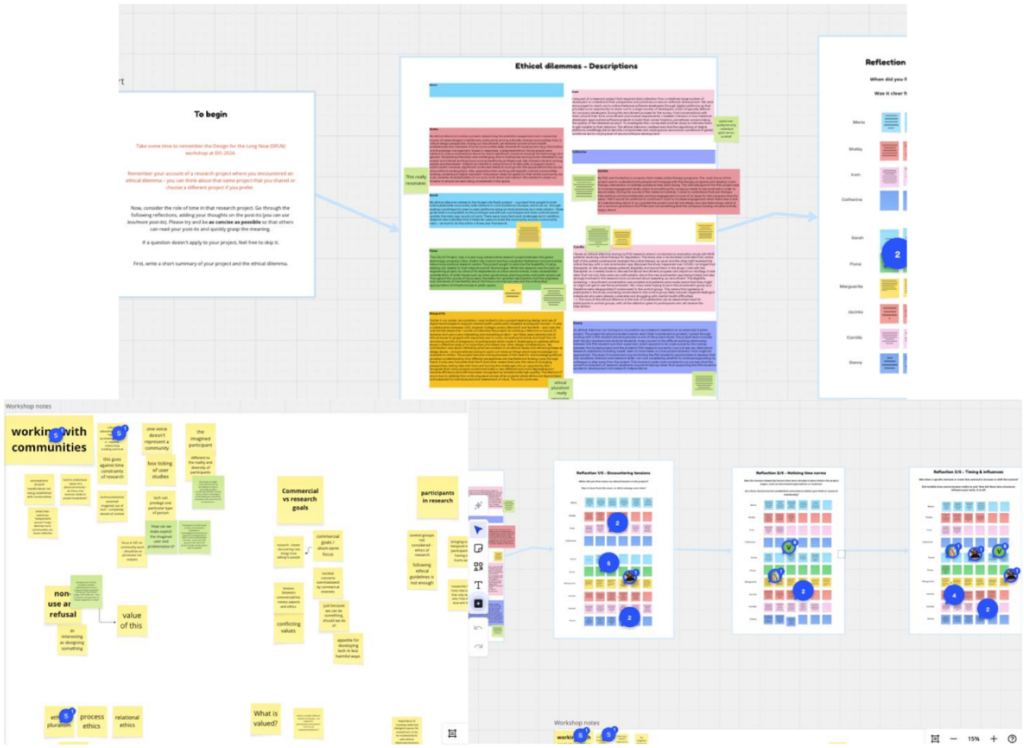


Figure 1: Screenshot of Miro Board with instructions, descriptions and comments capturing discussion

3.1 Presentation, positionality and guiding participation

This retrospective multi-ethnography reflected on nine real-world stories of HCI research and development where ethical dilemmas were experienced. These case stories reflect the spectrum of academic research experience from early career researchers [ECRs] engaging in doctoral and post-doctoral projects, to industry-research collaborations to large scale interdisciplinary international and inter-institutional initiatives, and span the domains of digital mental healthcare, urban infrastructure development, socially-engaged and critical media art practice, community technology development, AI-assisted public health, and security and software engineering. The diverse projects cover research relating to application design and evaluation, user studies, participatory and co-design methods and so on. While our narrative reflection and analysis includes examples from across all of these stories, we do not give extensive detail on the specifics of projects or cite their outputs in analysis. This helps to preserve anonymity but also serves to retain the focus on the shared temporal-ethical features of research practice rather than individual project specifics. We wish to draw attention to the plurality of experience and the common ground within diversity, rather than unique aspects of projects which may dominate project and ethical reflection. Further, it is important to stress that ethical tensions are not considered detrimental or problematic for these or any projects but are a necessary and expected aspect of the research process. In many cases, the issues arising were productive and generative, containing rich potential for new and unexpected insights and outputs. A further motivation for this work is in illustrating the value of infrastructural inversion for such continuous ethical reflection, towards generating a collective response and crucially, making more time for it.

The participant co-authors represent different expertise, backgrounds, and interests in thinking (differently) about time in technology design and development, which includes extensions of philosophical and theoretical lines of enquiry, creative exploration and practice-based interventions as well as activist dimensions in their work. The participant co-authors are mostly (but not all) women from five different countries in the Global North, a potential limitation which reflects the emergence of this work from voluntary participatory workshops and communication via networks of collaborators. However, we consider the contributions to remain valid in addressing an under-researched topic and opening opportunities for reporting on the integration of temporality and ethics. On inviting the workshop participants to continue with reflection and follow up activities, we offered some guiding motivations as follows:

- We propose that temporalities are made through the relational features of infrastructure identified in [93, 94]

- We wish to explore whether these features could support analytical thinking about how temporal norms in research reflections could be made visible
- We aim to develop this in a way that supports wider understanding of the temporal barriers and enablers for ethical design
- We are inspired by the potential of seeing 'time as method' in HCI following [31] and the capacity to open further dialogue in this space

3.2 Time as a component of method

Here we clarify how temporality is both a subject and a shaping element of this research. Time itself fundamentally fashions what we can do and know in our scholarship [31] and more honest reporting of temporal constraints in research is necessary for sustainable practices [44]. Time is implicated in our study in two distinct and separate ways - the temporal elements which are the subject of reflexive analysis of separate projects as reported in Section 4, and the specific temporal experiences which shaped the development and writing of this paper which we reflect on here. Our analysis and writing took place over a period of about two years of (calendar) time within which each scholar had different temporal experiences due to external competing (time) pressures affecting their ability to engage, capacity to prioritise, to attend meetings, make time to reflect, write/edit/comment etc. We made use of many of the typical temporal ordering devices familiar to scholars, to help with diverse challenges in progressing the work which we list here following [32], in acknowledging the formal artefacts and processes of temporality. We present this list as just one view of the temporal pluriverse of research, in order to illustrate the infrastructural nature of collaborative scholarly activities (embedded, taken-for-granted, scope expanding, shaped by convention and built on other practices, after Star [93]), with each temporal element in bold having a different impact:

- shared online documents for **asynchronous** planning and writing (named/renamed according to **date**);
- an automated **calendar** invite for a **weekly regular** virtual meeting time with optional attendance, set deliberately for **'first thing' Monday mornings** (for reflection on different subjective temporal experiences);
- selected deadlines for submission to publication venues to motivate **progress** (e.g. abstract **first**, paper **a week later**), with **deadlines** missed and replaced by others;
- agreed **intermissions** in activity for intense teaching/service, or winter **break**, **resuming** in the **new year** with energy and resolve;
- absences due to competing **time/deadlines** for grant applications, health reasons, PhD submissions, caring responsibilities, promotion preparations, life events, new employments etc.,
- progress and further agreed **pauses** e.g. for summer/winter **break** to allow for deeper offline engagement but also detachment;
- inevitably, a loss of **momentum just as** a draft is taking shape; with apologies and kind words (about **time**), a **pause** cannot be **unpaused** – no reason, but **time**…
- **nine months** (a gestation) later, an in-person meeting at a HCI **commemoration** (appropriately) **restarts momentum** and activities **resume**; the **cycle** above **restarts** and **repeats** until we have a draft.
- we choose **completion** and opt to **end**.

This list depicts common features of a process of collaborative writing but does not even begin to describe the everyday temporal challenges that individual scholars negotiate while working on one project while balancing other commitments. Nor does it truly expose the psychological (perhaps even pathological) challenges scholars have with the intellectual juggle, often experiencing only 'illicit' time for writing [32] in a period of rapid accelerationism in academic work [100]. We acknowledge this process (as an infrastructural inversion) in order to highlight the banality of temporal norms which also impact heavily on ethical design processes and our capacity to act while engaged in empirical research. The challenge is to find ways to surface and maintain awareness of these temporal norms and tensions in ways that can be integrated into ethical methods, reflection, and action, while acknowledging that we simultaneously experience temporality, individually and collectively. In our reflexive analysis we note the temporal aspects of research artefacts (work in progress, schedules and communications), formal processes (submission dates, deadlines, reporting), decision making structures (recruitment/prioritisation, roles/responsibilities) and interpersonal dynamics (power relations, support and care), and how these are implicated in the research infrastructure. Scholars move both with and against acceleration through these processes, and we attempt to bring these elements to the surface through infrastructural inversion.

4 Analysis

Our analysis explores a variety of experiences and reflections on temporal aspects and tensions of infrastructure and their impact on potential for ethical reflection and response in research. We consolidate these observations under themes guided by the features of ethnographic infrastructure described in section 2 and adapted into guiding questions (see Table 2). In reporting on our findings, we highlight examples from the multi-ethnographic process of reflecting on projects and illustrate these experiences in the first-person using quotes from the narrative accounts and discussions of participants (as outlined in Table 1).

4.1 Encountering ethical tensions

Most reflections noted that often the most problematic ethical tensions on projects were not apparent at the start but were initially invisible and emerged over time, sometimes late into a project timeline. Many contributors reflected back to a point where there could have been an intervention but as it was only recognised later, the capacity for action was constrained. Key points of ethical encounter and recognition included data analysis processes, where issues emerged that could have been picked up earlier during participant recruitment or data gathering. For example, in P8's project, a 'control group' expressed disappointment not to also potentially benefit from a designed intervention, due to standard medical research genre conventions which make their needs as a participant

group invisible: *"I became aware of the issue at data analysis stage, when reading participants' qualitative responses to a survey... It was surprising to me that despite the number and expertise of the stakeholders involved [in research design], the issue wasn't anticipated..."* [P8]. This resulted in negative perceptions of the research process among participants and was reflected the qualitative data.

Further points of ethical encounter occurred during formal engagements with participants and stakeholders, or in observing their context as participants, indicating that some ethical issues only become visible through the eyes of others and are dynamic rather than static. For example, P2 encountered immediate concerns that indigenous communities had with GenAI and its potential for exploitation: "*It was clear from the start there would be tension because AI is very divisive... This tension became more clear as we contacted people for recruitment and received concerns over our project...*" [P2]. Elsewhere P4 was unfamiliar with a project on building sustainable community technologies and had "*joined the project one year in and could immediately notice an ethical tension about the project's competing goals to both scale a prototype rapidly, whilst also meeting community needs of building a sustainable socio-technical system that would last long into the future".* The tension was *"easily observable..."* because of their 'newness' and lack of socialisation within the taken-for-granted project assumptions that the prototype would be automatically accepted by the community.

Meanwhile, P5 experienced more intermittent points of ethical tension, in a project exploring IoT infrastructure in public spaces, which *"appeared sporadically over time, as glimpses of the taken-for-granted assumptions that the private business, city authority and engineers held were revealed"* [P5], particularly in relation to potential for commercial exploitation. This suggests that even though ethical issues can be encountered at any stage in research, from project ideation, to recruiting participants, data analysis, prototype testing and so on, recognition may come too late for a meaningful discussion of or decision on ethical implications, thus limiting the potential for adjustment and action.

It is also important to note that in all projects, ethical questions and issues were identified at the outset, some of which were dealt with in extensive ethics approval processes e.g. *"[formal health authority] ethics approval, which involved completing a long and complex form, and meeting with the [anon] REC committee, revising and resubmitting the documents & application form..."* [P8]. But the narrative reflections show that the formally identified ethical issues often do not manifest as the problematic tensions which have greatest impact later on. On reflection, P3 noted that *"much of the nuance and complexity of ethical considerations lies in what falls between the lines",* in this case in the clash between secure software development requirements and platform design constraints. Therefore, the infrastructural embeddedness of ethics review processes, at a fixed point early in project timelines, presents a false sense of security that ethical reflection is somehow complete. This can cloud the capacity for continuing reflection on further and more invisible embedded and sociotechnical issues and is a genre convention within HCI (and most research) that needs to be made more temporally dynamic.

4.2 Noticing temporal norms - projects, disciplines, values

Through our reflections, we recognise the impact of many infrastructural norms and standards operating in the background, which are rarely explicitly addressed in ethics processes but still have an effect on ethical reflection and action. The temporal infrastructural elements of projects themselves were commonly identified across all projects - timelines, deadlines, milestones - and their formal representations in artefacts such as 'work packages', 'deliverables', 'Gantt charts' and so on. These were seen to lead to a *"lack of care-time built into the project, privileging other temporal more technical elements*" [P4], in a project where participatory community research conflicted with software development timeframes, and which had to rapidly reorientate in response to community refusal. Such project norms were often specified in advance, meaning that projects were *"shaped by things that were already in place"* [P7], and without sufficient regard to *"human timelines...the contextual schedules of participants"* [P6], and which created *"a disconnect between doing community-based work and the requirements of academia".*

In some projects, power imbalances emerged around the control of temporal norms which meant that temporal arbitrage was experienced and *"urgency was sometimes unexpected or appeared unreasonable..."* [P9], especially for ECRs carrying out the research. In one case, this required *"certain activities to have been carried out by a certain date... and the time obligation created a sense of performative progression"* [P9] rather than meaningful research progress. Ethical issues only became apparent *"... through amendments or questioning of materials that had existed for several months but were only addressed close to a deadline"* [P9] which suggests that temporal norms are often inadequate for producing the kind of 'release valves' needed for ethical reflection. For ECRs in particular, this culture of linear progress and urgency can conflict with scholarly development and making opportunities to pause for reflection. For example, P7 reflected on the point where their research departed from the commercial aspects of the project: *"at this point of divergence...I couldn't do everything, I had to finish my PhD and tell a coherent story with it"* [P7], echoing widely held experiences of 'publish or perish' cultures compounded by accelerationism in academic research.

Disciplinary or stakeholder temporal norms also shape the research aims and values of a project. These become visible for example where early research findings indicate ethical concerns with assumptions about future use of application designs, especially with indications that non-use or non-design may also be a valid response to research findings. For P5 on the IoT project, these norms were identified where there were *"inherent tensions... predisposed between private industry interests and socio-technical research and a sense of inevitability about the future commercial uses",* and for P7, *"the expectation that I would develop a technology"* even when the research would subsequently recommend against development. For P8, this is compounded by discipline specific genre conventions, methods and evidence hierarchies, for example *"the involvement of collaborators who were used to conducting RCTs [Randomised Controlled Trials] and publishing in medical venues... when I didn't need an RCT to answer my research questions".* This disciplinary privilege,

particularly evident in technology and health projects, puts pressure on researchers to adhere to norms even though they might shape research encounters in unfavourable ways. For example, P6 noted that *"medical politics…can have an impact on who gets to participate in research and when, due to the norms of clinical practice and how they differ…",* while P2 observed temporal imbalances between clinicians and patients, where *"in underserved communities, finding time to meet with healthcare professionals is difficult".* Time appears central to how disciplinary norms were experienced, what was encouraged, and what was constrained.

Researcher isolation also makes some participants more vulnerable in relation to ethical reflection, and in relation to the power to change course or address an ethical issue which reflects the impact of temporal orders and power within research teams. For example, when assumptions slowly crystallised around the commercial potential of IoT project assets in public spaces, P5 felt constrained: *"As the lone critical humanities researcher on the project and the fact that I was an ECR learning the lay of the land, I did not challenge the established conventions as I felt outnumbered and inexperienced. In retrospect, I should have spoken out and called the others out on the ethical issues and dubious assumptions but I'm not confident that would have changed anything…"* Elsewhere, a sense of friction between researcher positionality and project assumptions creates moments for surfacing ethical tensions when, for example, P6 stated: *"As the only female member of the project research group who also had experience of [condition], I was aware of things that the rest of the group perhaps were not and could bring this perspective to the discussion on research and design…"*

ECRs note the impact of disciplinary norms in a culture where academic progress prioritises meeting deadlines over pausing for reflection and potentially taking alternative action. Some participants also noted challenges with 'speaking out' on ethical issues often due to their positionality (linked to research stage, precarity, gender, discipline and age), and tensions between project norms and values and their own researcher sensibilities and values. These reflections indicate that explicitly identifying temporal norms is particularly important for inter- and multidisciplinary projects and a useful practice for all even before any ethical tensions arise. Having different positionality, including a different disciplinary gaze can aid with surfacing and making visible ethical tensions. However, naming ethical tensions also requires the power and capacity to voice and call out different perspectives.

4.3 Timing, Pace, Scope - conventions of practice and its chronopolitics

Our narrative reflections showed that ethical tensions could appear either suddenly or gradually, with their timing impacting on potential for reflection and capacity to respond. For example, in P2's project an unexpected tension arose around participants' attitudes to and expectations of AI, the core technology domain of the project. This instantly required pausing progress to address their ethical questions and finding ways to do this within community timelines that are already overburdened: *"…the issue appeared suddenly in terms of general AI concerns. Some people were hesitant to have conversations about AI, due to significant concerns towards the technology in general. Scheduling interviews was challenging, due to hesitancies among those interested in our project and their intense working hours…"* [P2]. This was similarly experienced in P4's project, where the community rejected the use of voice-to-speech technology, citing ethical concerns with how voices could potentially be (mis)used. P4 found that design-based methods such as workshops, did not align temporally with the life-worlds of busy rural participants, leading to a reorientation towards community-based methods that were based on reciprocity and recognised a community's sense of time.

For other researchers, their own recognition of the ethical issue had a direct impact on increasing pace and scope: "*It happened suddenly… it hit me when reading the disappointment in participants' survey responses…"* [P8], which required an immediate reconsideration of the findings. Elsewhere on the software security project, the pace and timing of reflection grew for P3 as research progressed and involved more participants in individually recruited qualitative interviews: *"tensions built up gradually and varied since [participants] came from different socio-economic and socio-technical backgrounds",* with the added challenge of communicating with participants via platforms whose design constrained access. On the community technology project, the linear practice conventions of 'build-test-maintain-repair' created gradual tensions and frustrations, especially *"when the prototype didn't work as planned, when developers were not always available to train, repair etc."* when the community wanted it. Similar conflicts arose due to differing disciplinary/stakeholder practices and conventions in the IoT project, where *"the fast pace of development in the company was not aligned with the pace of academic research"* [P7] and on the AI recommender systems project where differences in pace and timelines created *"waves of tension as deadlines come and go"* [P9].

Researchers frequently need to negotiate their capacity to navigate potential for ethical reflection, whether in small projects under their control or large projects with competing goals/timelines. For most, in terms of scope, the range and diversity of stakeholders and participants was a bigger challenge than the size of the project itself. Therefore, the scope of ethical reflection required appears to be related to the differing values and goals across stakeholders and locations rather than the size and complexity of build or scale of research outputs expected. This directly impacts on the capacity to navigate complex chronopolitics and make time for ethical reflection and action. For example, for P4 *"developing a sustainable community [technology] takes a minimum of ten years, but the project suggested we needed to do this within three…the project was multi-country… it was…focused on scaling up a technology across diverse rural cultural contexts…"* [P4]. For projects whose participants are remote precariously employed software developers, there was a tension in, *"getting access to [participants] who are unreachable through the digital platforms*" [P3], indicating how technology design itself and the temporal norms embedded within them can have a chilling effect on some forms of research.

Crucially, control over the project scope and its temporal features appears to be a core issue in enabling or constraining action: *"The scope of the project was not always clear to the whole research team…prioritisation can shift urgency and alter timelines even though the work and goals may be the same"* [P9]. Yet, for others the potential for reducing the scope introduced its own stresses: *"The size and*

scope of the project was largely determined by me… And it was constrained by my own availability and funding deadlines" [P1]. These reflections indicate that the capacity to see, pause and reflect on ethical issues arising at different points is closely linked to issues of chronopolitical awareness and infrastructural arrangements across projects.

4.4 Responses and Adjustments - making time for ethical action

Within some projects, there were opportunities for responding to ethical issues recognised early on, through direct in-project decisions to change project deadlines, activities, methods or objectives. For example, P2 engaged with community members and realigned research plans, recognising that *"because recruitment was difficult, we changed the scope and timeline to last longer for initial interviews… It's important to hear a variety of opinions, from positive to negative, early on. Even when that means pushing deadlines or goal-dates back."*

Elsewhere, participants acknowledged that adjusting in order to cope with ethical issues meant simply abandoning some incompatible project goals, such as in the community technology project where misalignment between community and development aims, meant prioritising community socio-technical goals. As P2 notes, *"there were many tensions that we didn't manage to address - the technology was never going to be accepted by the community… We did focus on non-use/refusal as generative; we let go of the conflicting goals of the project and focused on sustainability…of the socio-technical system"*. In their reflection on using socially engaged art with teenagers to explore meanings of place, P1 noted that sometimes "*the project has to happen and fail for us to fully understand needs/values etc,* [which] *points to the value of failure and prioritising non-use / refusal as research outcomes".*

Some reflexive narratives raised wider questions about the temporal disciplinary and methodological adjustments required in order to adequately build capacity for ethical intervention in general. In reflecting on how participatory innovation processes aim at scaling, in a multi-country project, P4 noted that whilst: *"the project was described as participatory, I would have preferred to do much more community based participatory research based on community needs 'with' the community"* but deeper participatory research would have required more time and a slower research pace. For similar projects whose participants are remote and precariously employed such as freelance software developers, there was a tension in *"getting access to [participants] who are unreachable through the digital platforms*" [P3], but whose insights are needed for practical actions. On reflection, P3 would have liked to be able to algorithmically assist with security interventions, but the platform design itself and the temporal norms embedded within served to prevent and have a chilling effect on such responses. Elsewhere, participants suggested that formal structures needed to be questioned: *"[In RCTs] our way of thinking about control groups as less important participants should absolutely be challenged… This is reflected in ethics application reviews which are mainly (solely?) concerned with the intervention group"* [P8]. These reflections indicate the importance of understanding 'who' the research infrastructure is for, and how care-time for different groups might be better integrated into the research process and infrastructure.

Our discussions also addressed broader questions of who has responsibility for ethical reflection and asserting values, while also recognising the chrono- and socio-political context of research: *"I don't think this is necessarily something we can fix, it is our job to step back when significant concerns are raised and re-evaluate…We need to do continuous work to address concerns to the best of our abilities and know when it's time to step away from a certain goal…"* [P2]. For some researchers the price of pausing and changing direction was existential: *"Although the team I was working with were highly supportive, the wider company were not exactly impressed with the lack of concrete deliverables and solutions - the timing may have been a coincidence, but they made me redundant as soon as they could…"* [P7]

Regardless of the potential for action or its appropriateness, any decision to adjust or respond to ethical tensions depends not just on having the *time* to make value adjustments in favour of ethical decisions, but even the *temporal power* and position to make decisions, as well as the capacity to absorb any perceived negative effect on project timelines, progress, relationships or even on career. Crucially, it also involves access to multiple perspectives which may be infrastructurally blocked. As P2 noted, this is relevant to persistent cultures in our field: "*In academia, it's easy to purely base success and progress on deliverables being met and papers being published. However, true HCI progress comes with serving and/or respecting the people at the centre of research, even when it takes a very long time…"*

These reflections indicate that capacity for and attitudes to responding to ethical tensions as well as diverse strategies to effect change, are strongly related to infrastructural and chronopolitical factors around researcher, participant and stakeholder involvement. Whether adjusting early on in response to participant feedback or abandoning aims and changing course, strategies emerge in different ways and raise questions not just of capacity but of the responsibility to act.

5 Discussion

Our findings illustrate how research is temporal, relational and infrastructural but that its temporal features – often obscured within taken-for granted norms – can be made concrete through infrastructural inversion. By using a multi-ethnographic approach informed by chronopolitics and infrastructural studies, we have shown how temporal aspects of research infrastructure become visible through moments of ethical breakdown. In the following sections we discuss how the findings describe characteristics of temporal tensions, the pluralities of temporal experience and encounters that mobilise ethical reflection and action.

5.1 Temporal tensions in research and design: Making care-time for dynamic research

Across all of our narrative reflections, we recognise that many of the ethical tensions and deliberations experienced are underpinned by the inherent distinction between the social and technical aspects of technologies and systems, and the misalignment of temporal norms

associated with each. For example, the rush to get research/technology 'out there' is privileged over the slower time needed for understanding and integrating values and situated knowledge in projects that ranged from RCTs to participatory design, echoing the studies which have established this issue of temporal mismatch between 'progress' and values

for over two decades [61, 88]. In our reflections, temporal norms support visions of progress, that are in contrast with the lived realities of interdependent communities or expectations of multistakeholder participants. Yet researchers who recognise the need for community building around technology as relational and infrastructural, feel pressured due to rigid project timelines and goals. Such tensions between fast and slow research approaches and norms again reflects established findings on problematic temporal technology practices [66, 88] and leads to a sense of extractivist engagements with research participants, with some researchers observing that infrastructure did not sufficiently support or recognise the 'care-time' needed for research. This also echoes feminist scholarship that indicates the importance of making visible the different temporalities at stake within HCI projects, which is not about slowing or redirecting timelines but an invitation to rebalance relations between a diversity of co-existing temporalities [72]. As Wiberg suggests, it is not that slow or fast are bad (both are needed) but the dominance of one over the other creates problems [104]. Disrupting taken-for-granted privileges of linear time is required to make room for care-time within HCI research as participants demonstrate in their reflections on capacity for adjustment and action.

We applied infrastructural inversion to help make visible the temporal tensions and relations which enable or hinder ethical reflection and action. By attending to the 'hyper-functional' elements of research experience [83], we developed an understanding of the subjective view of the researcher. This is illustrated at the point of 'noticing norms', for example in the standard omission of RCT control groups from consideration, or with new researchers immediately identifying previously unrecognised (or unseen) ethical issues in a project, and even in the attempts to 'respond and adjust' through reorientation of project aims, including in cases of user refusal, and even of researcher refusal. From this perspective, refusal does not necessarily mean closure but is considered as generative and where participants are empowered to consider the implications of non-adoption, non-design and non-engagement with technology [26, 48, 79]. While refusal is regarded as an essential element of any democratic process [26], we must also acknowledge that not everyone has the power to refuse, particularly within commercial logics [25]. But without sufficient care-time in research, refusal may be the only appropriate and ethical response.

Our reflections show how some researchers are protected by position and fixed schedules while less powerful and precarious researchers must organize their time around those with more temporal power, or risk losing their job. Temporal tensions can result in the redistribution of temporal burdens onto ECRs, or the participants we engage with, where their time is often expected and extracted, regardless of whether they will benefit or not. This reflects critical work which has examined the impact of the design and use of temporal tools such as Gantt charts for example, where time is considered as a limited resource in competition with other resources (people, money), a framing better suited to projects with predictable set goals, rather than complexity and uncertainty, and which promotes a kind of performative project management [35]. We suggest that this occurs due to established temporal norms and conventions, the shared enactment of which can unintentionally create the conditions for temporal arbitrage [18] and squeezing out care time [86, 87]. Not everyone is equally responsible, and those with temporal power as well as the ability and interest in exercising it, carry different levels of responsibility [78, 79, 112] and may need to be encouraged or even pressured to act on ethical issues.

Temporal power accrues via research infrastructure to research funders, research management and technology industry interests, but those who are impacted most and are more likely to engage in temporal arbitrage may have more capacity to envisage reform of temporal infrastructure in research. The first step towards achieving temporal and infrastructural justice (which we understand as freedom from temporal domination and oppression), is to make these norms visible as well as the structures which support them. Only then, as a community can HCI research seek ethics reform through collective action [78].

5.2 Ethical encounters in existential time: who is the temporal research infrastructure for?

Our project reflections illustrate how individuals relate temporally to the world and to their research, based on their position and interactions with what is available to or present at hand. This reflects the concept of existential time, which is a product of design and research itself and produced within 'the possibilities offered by a specific group's historicity and handiness' [1] echoing Heidegger [42]. Our study highlights the importance of ethnographic analysis of research practice in helping us to understand this 'link between ethics, design, temporalities and world-making' [1, p.34]. Understanding time, and recognising our subjective experience, acknowledges that ours is just one of many diverse experiences on a project or team, and only one of many temporalities. Rovelli [80] states that we can only speak of our experience of time, as multilayered and complex and ultimately consisting of an 'emotional dimension' [ibid, p.174]. This emotional quality necessitates allowing every individual perspective to be seen and heard through an ethically pluralist approach and understanding that temporalities are plural and dynamic rather than fixed.

These narratives contain a sense of defamiliarisation through the multi-ethnographic process, where temporal norms jarred with individual encounters, making the plurality of temporalities visible. For example, ethics review processes are an embedded part of research infrastructure, often providing the starting line for research, and a sense that ethical reflection is complete. However, this obscures the capacity for continuing ethical reflection on more invisible issues arising suddenly or gradually, and which formal processes seem unable to address [8]. The timing of ethical awareness may not limit our ability to act, but it significantly constrains the choices available in late-stageness. Many research projects would benefit from a parallel process from the outset, that allows for integration of everyday ethics [3] and/or everyday wisdom through recognising ethical pluralism [5] in a more dynamic and temporally responsive ethical research process. This has real-world implications for how the HCI community views ethics as something fixed

in one moment in time, or dynamic, reflexive and supportive of emerging reflections. Future research and design workshops could explore through design what such an everyday ethics process could look like, and how it might fold into and complement other project norms to allow for a continuous infrastructural inversion that does not disrupt but enriches progress.

Identifying temporal norms across project teams is essential for all even before any ethical tensions arise, but it is particularly vital for inter- and multidisciplinary projects where the power and capacity to voice different perspectives is more challenging, although arguably more generative. Intersectionalities such as gender, age, precarity, career and disciplinary status create extra challenges in the chronopolitics of ethical reflection and action, but also opportunities in the pluralism of temporalities. Star [94] notes how infrastructures prioritise their own members over others and so, the capacity for and attitudes to responding to ethical tensions as well as diverse strategies to effect change, are strongly related to temporal factors around diverse participant and stakeholder involvement. Whether adjusting early on in response to participant feedback or abandoning aims or changing course, we see that strategies for taking action can raise questions not just of capacity but the responsibility to act or even to refuse. This suggests the possibility of choosing to abandon prior information and starting afresh, in recognising the 'value of forgetting in design' [4, p.16]. Opening ourselves to other existential temporalities creates empathy but also assigns more responsibility to those with more temporal power, thus creating the conditions for ethical pluralism.

Our reflexive narratives contain many examples of parallel, fluctuating, patterned and sporadic temporalities which reflect various temporal rhythms in collaborative work noted in prior studies [52]. We suggest there is also potential for an extra 'ethical' rhythm arising from temporal pluralism, that recognises uncertainty, shows an understanding of the sources of paralysis in decision-making, allows for interruption and supports cooperation [4] towards promoting everyday wisdom [5]. Ethical rhythms can be attuned in an individual capacity [after 104] through making ourselves more confident, accountable and flexible towards supporting more sustainable research. This requires attention to the order of discourse - who gets to speak and when, whose values are represented and when - a chronopolitical and infrastructural element with implications for research participants as well as researchers themselves [5].

Temporal power is embedded within infrastructure and design, from the moment where funders set budgets, timelines and deadlines. Some will gain (perhaps unknowingly) from temporal arbitrage through research experience and seniority, while others will endure it in the hope of unknown future benefits. Temporal arbitrage in research can lead to ethical arbitrage where temporal power dictates whose values are prioritised and when. By identifying ethical rhythms individually and collectively - as part of the process of naming temporal norms and pluralities – we can promote the incorporation of everyday wisdom.

Whether exploring refusal, playing with ethical rhythms, or learning how to surface hidden temporalities, scholars need support within research infrastructures to experiment with and embed these elements in our processes. We have seen how previous studies have favoured workshops for research on temporality in HCI [6, 19, 91], which facilitate the time needed for reflective ethnographic methods, and the space to gather together as researchers for infrastructural inversion as collective action to take place. Current research infrastructures impose temporal constraints on the potential and value of workshops but, as Star [93] reminds us, infrastructure grows from the bottom up and the HCI community could augment the workshop concept to provide for new more dynamic formats for temporally aware research. For example, we could go beyond the single meet up moment at a conference towards facilitating multiple and continuing synchronous and asynchronous collaboration opportunities, over longer 'timeframes', or at regular intervals over years within a conference – supporting connected dynamic activities, outputs and forms of dissemination. We need new temporal methodologies because, to paraphrase P2, true progress comes with respecting the people at the centre of research - firstly ourselves.

This study has reflected on tensions that are often marginalised in the prioritisation of success narratives in research and its outputs. Echoing Howell et al [44] we recognise and name our 'lingering feelings of discomfort, frustration, or guilt' [p.26] in order to illustrate that these are not emotional responses to perceptions of ethical failure, but are indicators of infrastructural inversion which has a generative and emancipatory potential. We offer this as a response to 'entanglement' in HCI [36], and acknowledge the need for 'collapsing ontology, epistemology and ethics into one' and to develop methods towards more 'meaningful relations' [ibid, p.22]. Entanglement suggests that we cannot easily separate temporality and the research process from the technologies and services that we design. This study offers a way forward in the current wave of research that directly engages with how the scholarly infrastructural and temporal experience of researchers shapes our ways of knowing and our ethical capacity, and acts as a call to action to reimagine a temporal pluriverse. In the next section, we offer some pragmatic considerations to help researchers develop temporal awareness and sensitise research to chronopolitical issues that can impact on ethical reflection and intervention.

5.3 Considerations for developing temporal awareness for ethical research in HCI

Temporal awareness can and should be considered at all levels in research, from our personal and subjective (micro) temporalities, to our project team and stakeholder (meso) interactions, to the wider domain, community, institutional and disciplinary field (macro) conditions, all of which are experienced often simultaneously through research infrastructure. We offer the following four considerations as a guide when initiating projects, as a tool for when intervention is required during research, and as a prompt when generating design activities to support new directions in research.

a) Make temporal norms and temporal pluralities visible.

- Identify and bring to the surface personal, project, disciplinary, institutional temporal features at the outset; Avoid being prescriptive and recognise temporal and ethical pluralism
- Consider the impact of temporal institutional and genre conventions in HCI and/or other interdisciplinary inputs

- Experiment and play with parallel fictional and alternative temporal features to surface and compare hidden internal/external tensions, rigid/flexible nodes and points of adaptability
- Regularly revisit temporal norms/pluralities throughout as a core project activity, especially with integration of new participants, and as a counterpoint to the rigidity of normative project artefacts (e.g. the Gantt chart)

b) Identify chronopolitical challenges and mobilise the responsibility that comes with temporal empowerment.

- Recognise the implicit temporal hierarchies across multidisciplinary projects, and temporal tensions created through pluralities
- Engage in defamiliarisation to support reflection and potential for responsibility through non-design, disengagement and refusal as ethical practice. And acknowledge that these counter-practices do not feel available to everyone.
- Address temporal arbitrage and redistribute power, enabling all involved in research to reflect and act; promote ethical rhythms for everyday wisdom

c) Attend to the dynamic nature of ethical reflection.

- Create built-in moments of reflection across projects and provide space (and time) to allow ethical implications of temporalities to unfold
- Make room and build in 'care-time' for flexibility and dynamic response to emerging temporal and ethical tensions
- Pay close attention to participants, ECRs and those from disciplines that privilege one temporal mode over another; Accept that temporal misalignment may lead to isolation and difficulty in speaking up when ethical tensions emerge; See this as the norm, rather than unprecedented in all project contingencies.

d) Promote collective action for ethical HCI research.

- Engage in and support collaborative temporal methodologies to support ethical reflection e.g. dynamic workshops which can facilitate continuing synchronous and asynchronous collaboration opportunities
- Incorporate a sense of infrastructural justice in research processes; for example, by addressing chronopolitical aspects of research infrastructural processes
- Motivate community, institutional and field approaches to reform of research ethics review supports, in recognition of temporal awareness for dynamic ethical reflection

5.4 Limitations

This study is limited to reflections based on the experiences of researchers as participants in our workshops and in the resulting study. The topics addressed in the reflexive narratives explore projects and case studies which, while varied, only represent a small subset of the work carried out in the field of HCI and more broadly in technology design and development. These reflections also do not address many other infrastructural and chronopolitical features such as finance, identity, culture, geopolitics and many other relevant aspects of temporality. However, we offer our reflections and considerations as a starting point for developing temporal awareness and hope to offer a form of communicative generalisation [22], where the significance of this knowledge is in recognising HCI as a specific epistemic community that shapes and holds temporal power. A wider diversity of domains, experiences and perspectives would no doubt add greater complexity and deeper understanding of temporal awareness for ethical design. Studies which include perspectives of lead academics, grant holders, industry funders and stakeholders and other co-design participants would further enrich these insights and we hope that future research will explore chronopolitics of research within multi-stakeholder contexts.

We have offered four considerations as a proposal for developing deeper temporal awareness and to support ethical reflection and action. Future research could assess how these (and other) considerations might be operationalised and develop tools to assist with capturing existential project temporalities and ethical rhythms, as well as processes for evaluation of impact both on projects and on individuals.

6 Conclusion

In this paper, we have used ethnographic methods to capture researcher reflections on temporality in HCI research and its impact on ethical reflection and action in design and development practices. We have described and analysed the infrastructural/systems elements of reported projects and workshop-inspired reflections, as well as the personal experience of existential time to help illustrate the impact of time and temporality on ethical reflection. We have attempted to place a structure on the reported experiences of in-project time - through infrastructural inversion and chronopolitical analysis - and have explored these features with reference to prior empirical and theoretical research. In doing so, we have examined *'when'* temporal infrastructure is relevant for ethical reflection and for whom. Finally, we offer four considerations for researchers to explore in their own research projects and academic engagements.

Just as digital technologies are socio-technical in nature, so is time. Therefore, in this study we take care with and acknowledge the potential for both technological and temporal determinism. The identification of timescape and infrastructural features does not indicate that these features determine some kind of pattern, focus or rhythm in design and development. Nor do the technologies themselves serve to shape or determine aspects of temporality. Indeed, we do not even take temporality as an unproblematic analytical framework but introduce it as a means for reflection on ethics in practice, a mode to consider when seeking to understand where ethical tensions might arise and how they might be addressed. An orientation towards the temporality of research offers potential for alternative perspectives on how we engage with power and responsibility for ethics in research and design. We encourage researchers to further engage in infrastructural inversion and chronopolitical reflection in developing their own temporal awareness for ethical research practice.

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References

[1] Frederick M.C. van Amstel and Rodrigo Freese Gonzatto. 2022. Existential time and historicity in interaction design. *Human–Computer Interaction* 37, 1: 29–68. https://doi.org/10.1080/07370024.2021.1912607

[2] James Auger. 2013. Speculative design: crafting the speculation. *Digital Creativity* 24, 1: 11–35. https://doi.org/10.1080/14626268.2013.767276

[3] Sarah Banks, Andrea Armstrong, Kathleen Carter, Helen Graham, Peter Hayward, Alex Henry, Tessa Holland, Claire Holmes, Amelia Lee, and Ann McNulty. 2015. Everyday ethics in community-based participatory research. In *Knowledge Mobilisation and Social Sciences*. Routledge.

[4] Liam J. Bannon. 2006. Forgetting as a feature, not a bug: the duality of memory and implications for ubiquitous computing. *CoDesign* 2, 1: 3–15. https://doi.org/10.1080/15710880600608230

[5] Marguerite Barry, Kevin Doherty, Jose Marcano Belisario, Josip Car, Cecily Morrison, and Gavin Doherty. 2017. mHealth for Maternal Mental Health: Everyday Wisdom in Ethical Design. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (CHI '17), 2708–2756. https://doi.org/10.1145/3025453.3025918

[6] Marguerite Barry, Aphra Kerr, and Oliver Smith. 2020. Ethics on the ground: from principles to practice. In *Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency* (FAT* '20), 688. https://doi.org/10.1145/3351095.3375684

[7] Armi Behzad. 2023. Co-shaping Temporality: Mediating Time through an Interactive Hourglass. In *Companion Publication of the 2023 ACM Designing Interactive Systems Conference* (DIS '23 Companion), 241–245. https://doi.org/10.1145/3563703.3596637

[8] Steve Benford, Chris Greenhalgh, Bob Anderson, Rachel Jacobs, Mike Golembewski, Marina Jirotka, Bernd Carsten Stahl, Job Timmermans, Gabriella Giannachi, Matt Adams, Ju Row Farr, Nick Tandavanitj, and Kirsty Jennings. 2015. The Ethical Implications of HCI's Turn to the Cultural. *ACM Transactions on Computer-Human Interaction* 22, 5: 1–37. https://doi.org/10.1145/2775107

[9] Amel Bennaceur, Carlo Ghezzi, Jeff Kramer, Bashar Nuseibeh, Hannes Werthner, and Julian Nida-Rümelin. 2024. Responsible software engineering: Requirements and goals. *Hannes Werthner· Carlo Ghezzi· Jeff Kramer· Julian Nida-Rümelin· Bashar Nuseibeh· Erich Prem·*: 299.

[10] Maggie Berg and Barbara Seeber. 2016. *Slow Professor: Challenging the Culture of Speed in the Academy*. University of Toronto Press.

[11] Susanne Bødker. 2015. Third-wave HCI, 10 years later—participation and sharing. *interactions* 22, 5: 24–31. https://doi.org/10.1145/2804405

[12] Susanne Bødker, Sarah Fox, Nicolas Lalone, Megh Marathe, and Robert Soden. 2023. (Re)Connecting History to the Theory and Praxis of HCI. *ACM Trans. Comput.-Hum. Interact.* 30, 2: 16:1-16:7. https://doi.org/10.1145/3589804

[13] Ryan David Bowler, Benjamin Bach, and Larissa Pschetz. 2022. Exploring Uncertainty in Digital Scheduling, and The Wider Implications of Unrepresented Temporalities in HCI. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (CHI '22), 1–12. https://doi.org/10.1145/3491102.3502107

[14] Thomas Breideband, Poorna Talkad Sukumar, Gloria Mark, Megan Caruso, Sidney D'Mello, and Aaron D. Striegel. 2022. Home-Life and Work Rhythm Diversity in Distributed Teamwork: A Study with Information Workers during the COVID-19 Pandemic. *Proc. ACM Hum.-Comput. Interact.* 6, CSCW1: 95:1-95:23. https://doi.org/10.1145/3512942

[15] David Cairns. 2024. 'You're working, but you're not working:' academic precarity, ambivalence and the use of researchers as factotums. *British Journal of Sociology of Education* 45, 5: 708–722. https://doi.org/10.1080/01425692.2024.2355176

[16] Rafael A. Calvo and Dorian Peters. 2014. *Positive Computing: Technology for Well-Being and Human Potential*. The MIT Press.

[17] Inha Cha, Ajit G. Pillai, and Richmond Y. Wong. 2024. Ethics Pathways: A Design Activity for Reflecting on Ethics Engagement in HCI Research. In *Proceedings of the 2024 ACM Designing Interactive Systems Conference* (DIS '24), 3515–3533. https://doi.org/10.1145/3643834.3660714

[18] Julie Yujie Chen and Ping Sun. 2020. Temporal arbitrage, fragmented rush, and opportunistic behaviors: The labor politics of time in the platform economy. *New Media & Society* 22, 9: 1561–1579. https://doi.org/10.1177/1461444820913567

[19] Hyungjun Cho, Jiyeon Amy Seo, Heekyoung Jung, EunJeong Cheon, Woosuk Seo, Maria Luce Lupetti, James Pierce, and Graham Dove. 2025. Design Knowledge in AI: Navigating Temporality and Continuity. In *Companion Publication of the 2025 ACM Designing Interactive Systems Conference*. Association for Computing Machinery, New York, NY, USA, 61–63. from https://dl.acm.org/doi/10.1145/3715668.3734175

[20] Patricia Ciobanu and Ylva Fernaeus. 2024. Material Deconstructions of Time: Posthumanist Interventions Through Media Art. *ACM Trans. Comput.-Hum. Interact.* 31, 6: 80:1-80:47. https://doi.org/10.1145/3685267

[21] Claudio Coletta and Rob Kitchin. 2017. Algorhythmic governance: Regulating the 'heartbeat' of a city using the Internet of Things. *Big Data & Society* 4, 2: 2053951717742418. https://doi.org/10.1177/2053951717742418

[22] Flora Cornish. 2020. Communicative generalisation: Dialogical means of advancing knowledge through a case study of an 'unprecedented' disaster. *Culture & Psychology* 26, 1: 78–95. https://doi.org/10.1177/1354067X19894930

[23] Audrey Desjardins, Oscar Tomico, Andrés Lucero, Marta E. Cecchinato, and Carman Neustaedter. 2021. Introduction to the Special Issue on First-Person Methods in HCI. *ACM Trans. Comput.-Hum. Interact.* 28, 6: 37:1-37:12. https://doi.org/10.1145/3492342

[24] Sara Di Bartolomeo, Aditeya Pandey, Aristotelis Leventidis, David Saffo, Uzma Haque Syeda, Elin Carstensdottir, Magy Seif El-Nasr, Michelle A. Borkin, and Cody Dunne. 2020. Evaluating the Effect of Timeline Shape on Visualization Task Performance. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (CHI '20), 1–12. https://doi.org/10.1145/3313831.3376237

[25] Philip Dickinson. 2022. Time After Time: William Kentridge?s Heterochronies. *Angelaki* 27, 5: 97–112. https://doi.org/10.1080/0969725x.2022.2110398

[26] Carl DiSalvo, Annabel Rothschild, Lara L. Schenck, Ben Rydal Shapiro, and Betsy DiSalvo 2024. When Workers Want to Say No: A View into Critical Consciousness and Workplace Democracy in Data Work. *Proceedings of the ACM on Human-Computer Interaction* 8, CSCW1: 1–24. https://doi.org/10.1145/3637433

[27] Paul Dourish. 2006. Implications for design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '06), 541–550. https://doi.org/10.1145/1124772.1124855

[28] Anthony Dunne and Fiona Raby. 2013. *Speculative Everything: Design, Fiction, and Social Dreaming*. The MIT Press.

[29] Abigail Durrant and David Kirk. 2018. On Ethical Responsiveness: Being Answerable to Others as an HCI Researcher. *Interacting with Computers* 30, 2: 99–115. https://doi.org/10.1093/iwc/iwx021

[30] Sheena Erete, Yolanda Rankin, and Jakita Thomas. 2023. A Method to the Madness: Applying an Intersectional Analysis of Structural Oppression and Power in HCI and Design. *ACM Trans. Comput.-Hum. Interact.* 30, 2: 24:1-24:45. https://doi.org/10.1145/3507695

[31] Keri Facer, Johan Siebers, and Bradon Smith. 2021. *Working with Time in Qualitative Research: Case Studies, Theory and Practice*. Routledge.

[32] Keri Facer and Bradon Smith. 2021. Working with/in time: How university timescapes shape knowledge. In *Working with Time in Qualitative Research*. Routledge.

[33] Christopher Frauenberger. 2019. Entanglement HCI The Next Wave? *ACM Trans. Comput.-Hum. Interact.* 27, 1: 2:1-2:27. https://doi.org/10.1145/3364998

[34] Batya Friedman and David G. Hendry. 2019. *Value Sensitive Design: Shaping Technology with Moral Imagination*. MIT Press.

[35] Joana Geraldi and Thomas Lechter. 2012. Gantt charts revisited: A critical analysis of its roots and implications to the management of projects today. *International Journal of Managing Projects in Business* 5, 4: 578–594. https://doi.org/10.1108/17538371211268889

[36] Sandy J. J. Gould. 2022. Consumption experiences in the research process. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (CHI '22), 1–17. https://doi.org/10.1145/3491102.3502001

[37] Stuart Grant, Jodie McNeilly, and Maeva Veerapen. 2015. *Performance and Temporalisation: Time Happens*. Springer.

[38] Colin M. Gray, Shruthi Sai Chivukula, Thomas V Carlock, Ziqing Li, and Ja-Nae Duane. 2023. Scaffolding Ethics-Focused Methods for Practice Resonance. In *Proceedings of the 2023 ACM Designing Interactive Systems Conference* (DIS '23), 2375–2391. https://doi.org/10.1145/3563657.3596111

[39] Barbara Grimpe, Mark Hartswood, and Marina Jirotka 2014. Towards a closer dialogue between policy and practice. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 2965–2974. https://doi.org/10.1145/2556288.2557364

[40] Lars Hallnäs and Johan Redström. 2001. Slow Technology – Designing for Reflection. *Personal and Ubiquitous Computing* 5, 3: 201–212. https://doi.org/10.1007/PL00000019

[41] Sigrid Hartong, Mathias Decuypere, and Steven Lewis. 2024. Disentangling the temporalities of digital and predictive governance: Rhythmanalysis as a methodological framework. *Time & Society*: 0961463X241267338. https://doi.org/10.1177/0961463X241267338

[42] Martin Heidegger. 1996. *Being and Time: A Translation of Sein und Zeit*. SUNY Press.

[43] Sarah Homewood. 2019. Inaction as a Design Decision: Reflections on Not Designing Self-Tracking Tools for Menopause. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems* (CHI EA '19), 1–12. https://doi.org/10.1145/3290607.3310430

[44] Noura Howell, Audrey Desjardins, and Sarah Fox. 2021. Cracks in the Success Narrative: Rethinking Failure in Design Research through a Retrospective Trioethnography. *ACM Trans. Comput.-Hum. Interact.* 28, 6: 42:1-42:31. https://doi.org/10.1145/3462447

[45] Chung-Ching Huang and Erik Stolterman. 2014. Temporal anchors in user experience research. In *Proceedings of the 2014 conference on Designing interactive systems* (DIS '14), 271–274. https://doi.org/10.1145/2598510.2598537

[46] Jordynn Jack. 2006. Chronotopes: Forms of Time in Rhetorical Argument. *College English* 69, 1: 52–73. https://doi.org/10.2307/25472188

[47] Steven J. Jackson, David Ribes, Ayse Buyuktur, and Geoffrey C. Bowker. 2011. Collaborative rhythm: temporal dissonance and alignment in collaborative scientific work. In *Proceedings of the ACM 2011 conference on Computer supported cooperative work* (CSCW '11), 245–254. https://doi.org/10.1145/1958824.1958861

[48] Jacinta Jardine, Camille Nadal, Sarah Robinson, Angel Enrique, Marcus Hanratty, Gavin Doherty 2024. Between Rhetoric and Reality: Real-world Barriers to Uptake and Early Engagement in Digital Mental Health Interventions. *ACM Transactions on Computer-Human Interaction* 31, 2: 1–59. https://doi.org/10.1145/3635472

[49] Jacinta Jardine, Camille Nadal, Marguerite Barry, Daniel Snow, Fiona McDermott, and Sarah Robinson. 2024. Design for the Long Now: Temporal Tools for Navigating Ethics in HCI. In *Companion Publication of the 2024 ACM Designing Interactive Systems Conference* (DIS '24 Companion), 433–437. https://doi.org/10.1145/3656156.3658392

[50] Lara Karki, Dana Priest, James G. Dubose, Zajerria Godfrey, Annabel Rothschild, Ben Rydal Shapiro, and Betsy DiSalvo. 2025. A Window into DataWorks: Developing an Integrated Work-Training Curriculum for Novice Adults. In *Proceedings of the 56th ACM Technical Symposium on Computer Science Education V. 1* (SIGCSETS 2025), 568–574. https://doi.org/10.1145/3641554.3701826

[51] Aphra Kerr, Marguerite Barry, and John D Kelleher. 2020. Expectations of artificial intelligence and the performativity of ethics: Implications for communication governance. *Big Data & Society* 7, 1: 2053951720915939. https://doi.org/10.1177/2053951720915939

[52] Rob Kitchin. 2023. *Digital Timescapes: Technology, Temporality and Society*. John Wiley & Sons.

[53] Rob Kitchin and Alistair Fraser. 2020. *Slow Computing: Why We Need Balanced Digital Lives*. Policy Press.

[54] Laura Lascau, Sandy J. J. Gould, Duncan P. Brumby, and Anna L. Cox. 2022. Crowdworkers' Temporal Flexibility is Being Traded for the Convenience of Requesters Through 19 'Invisible Mechanisms' Employed by Crowdworking Platforms: A Comparative Analysis Study of Nine Platforms. In *Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems* (CHI EA '22), 1–8. https://doi.org/10.1145/3491101.3519629

[55] Yao Lyu, Jie Cai, and John M. Carroll. 2025. A Systematic Literature Review of Infrastructure Studies in SIGCHI. *Proc. ACM Hum.-Comput. Interact.* 9, 7: CSCW364:1-CSCW364:41. https://doi.org/10.1145/3757545

[56] Martino Maggetti, Fabrizio Gilardi, and Claudio M.Radaelli. 2013. Temporality. In *Designing Research in the Social Sciences*. SAGE Publications Ltd, 93–114. https://doi.org/10.4135/9781473957664

[57] John McCarthy and Peter Wright. 2023. The Value of Experience-Centered Design to Responsible Software Design and Engineering. *Design Issues* 39, 4: 61–76. https://doi.org/10.1162/desi_a_00737

[58] John McCarthy and Peter Wright. 2024. *Taking [A]part: The Politics and Aesthetics of Participation in Experience-Centered Design*. MIT Press, Cambridge, MA, USA.

[59] Shintaro Miyazaki. 2012. Algorhythmics: Understanding Micro-Temporality in Computational Cultures. *Computational Culture*, 2. http://computationalculture.net/algorhythmics-understanding-micro-temporality-in-computational-cultures/

[60] Alison Mountz, Anne Bonds, Becky Mansfield, Jenna Loyd, Jennifer Hyndman, Margaret Walton-Roberts, Ranu Basu, Risa Whitson, Roberta Hawkins, Trina Hamilton, and Winifred Curran. 2015. For Slow Scholarship: A Feminist Politics of Resistance through Collective Action in the Neoliberal University. *ACME: An International Journal for Critical Geographies* 14, 4: 1235–1259. https://doi.org/10.14288/acme.v14i4.1058

[61] Cosmin Munteanu, Heather Molyneaux, Wendy Moncur, Mario Romero, Susan O'Donnell, and John Vines. 2015. Situational Ethics: Re-thinking Approaches to Formal Ethics Requirements for Human-Computer Interaction. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, 105–114. https://doi.org/10.1145/2702123.2702481

[62] Peter Murphy. 2015. Living with Time: Discovery and Delivery: Time Schemas and the Bureaucratic University. In *Universities in the flux of time: an exploration of time and temporality in university life*, Paul Gibbs (ed.). Routledge.

[63] Camille Nadal, Shane McCully, Kevin Doherty, Corina Sas, and Gavin Doherty. 2022. The TAC Toolkit: Supporting Design for User Acceptance of Health Technologies from a Macro-Temporal Perspective. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (CHI '22), 1–18. https://doi.org/10.1145/3491102.3502039

[64] Wendy Norris, Amy Voida, and Stephen Voida. 2022. People Talk in Stories. Responders Talk in Data: A Framework for Temporal Sensemaking in Time- and Safety-critical Work. *Proc. ACM Hum.-Comput. Interact.* 6, CSCW1: 108:1-108:23. https://doi.org/10.1145/3512955

[65] Helga Nowotny. 2018. *Time: The Modern and Postmodern Experience*. John Wiley & Sons.

[66] Giovanna Nunes Vilaza, Kevin Doherty, Darragh McCashin, David Coyle, Jakob Bardram, and Marguerite Barry. 2022. A Scoping Review of Ethics Across SIGCHI. In *Proceedings of the 2022 ACM Designing Interactive Systems Conference* (DIS '22), 137–154. https://doi.org/10.1145/3532106.3533511

[67] William Odom, Siân Lindley, Larissa Pschetz, Vasiliki Tsaknaki, Anna Vallgårda, Mikael Wiberg, and Daisy Yoo. 2018. Time, Temporality, and Slowness: Future Directions for Design Research. In *Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems* (DIS '18 Companion), 383–386. https://doi.org/10.1145/3197391.3197392

[68] William Odom, Erik Stolterman, and Amy Yo Sue Chen. 2022. Extending a Theory of Slow Technology for Design through Artifact Analysis. *Human–Computer Interaction* 37, 2: 150–179. https://doi.org/10.1080/07370024.2021.1913416

[69] William Odom, Richard Banks, Abigail Durrant, David Kirk, James Pierce 2012. Slow technology. In *Proceedings of the Designing Interactive Systems Conference*. 816–817. https://doi.org/10.1145/2317956.2318088

[70] Gizem Oktay, Yuta Ikeya, Minha Lee, Bahareh Barati, Youngsil Lee, Yuning Chen, Larissa Pschetz, and Carolina Ramirez-Figueroa. 2023. Designing with the more-than-human: Temporalities of thinking with care. In *Companion Publication of the 2023 ACM Designing Interactive Systems Conference* (DIS '23 Companion), 104–106. https://doi.org/10.1145/3563703.3591462

[71] Séamus A. Power, Tania Zittoun, Sanne Akkerman, Brady Wagoner, Martina Cabra, Flora Cornish, Hana Hawlina, Brett Heasman, Kesi Mahendran, Charis Psaltis, Antti Rajala, Angela Veale, and Alex Gillespie. 2023. Social Psychology of and for World-Making. *Personality and Social Psychology Review* 27, 4: 378–392. https://doi.org/10.1177/10888683221145756

[72] Maria Puig de la Bellacasa. 2015. Making time for soil: Technoscientific futurity and the pace of care. *Social Studies of Science* 45, 5: 691–716. https://doi.org/10.1177/0306312715599851

[73] Amon Rapp. 2019. Design fictions for behaviour change: exploring the long-term impacts of technology through the creation of fictional future prototypes. *Behaviour & Information Technology* 38, 3: 244–272. https://doi.org/10.1080/0144929X.2018.1526970

[74] Amon Rapp, William Odom, Larissa Pschetz, and Daniela Petrelli. 2022. Introduction to the special issue on time and HCI. *Human–Computer Interaction* 37, 1: 1–14. https://doi.org/10.1080/07370024.2021.1955681

[75] Martin Riemer, Johanna Bogon, Nele Rußwinkel, Niels Henze, Eva Wiese, David Halbhuber, and Roland Thomaschke. 2023. Time and Timing in Human-Computer Interaction. 10.18420/muc2023. https://dl.gi.de/handle/20.500.12116/42073

[76] Michal Rinott and Orit Shaer. 2024. Temporal Aspects of Human-AI Collaborations for Work. In *Proceedings of the 3rd Annual Meeting of the Symposium on Human-Computer Interaction for Work* (CHIWORK '24), 1–7. https://doi.org/10.1145/3663384.3663397

[77] Sarah Robinson, Nicola J. Bidwell, Roberto Cibin, Conor Linehan, Laura Maye, John Mccarthy, Nadia Pantidi, and Maurizio Teli. 2021. Rural Islandness as a Lens for (Rural) HCI. *ACM Trans. Comput.-Hum. Interact.* 28, 3: 20:1-20:32. https://doi.org/10.1145/3443704

[78] Sarah Robinson, Jim Buckley, Luigina Ciolfi, Conor Linehan, Clare McInerney, Bashar Nuseibeh, John Twomey, Irum Rauf, and John McCarthy. 2024. Infrastructural justice for responsible software engineering,. *Journal of Responsible Technology* 19: 100087. https://doi.org/10.1016/j.jrt.2024.100087

[79] Sarah Robinson, Nicola J. Bidwell, Laura Maye, Nadia Pantidi, and Conor Linehan. 2020. Participation through substituting and refusing. In *Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 2* (PDC '20), 143–147. https://doi.org/10.1145/3384772.3385148

[80] Carlo Rovelli. 2018. *The Order of Time*. Penguin UK.

[81] Richard Sawyer and Joe Norris. 2015. Duoethnography: A Retrospective 10 Years After. *International Review of Qualitative Research* 8, 1: 1–4. https://doi.org/10.1525/irqr.2015.8.1.1

[82] Hanna Schneider, Malin Eiband, Daniel Ullrich, and Andreas Butz. 2018. Empowerment in HCI - A Survey and Framework. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (CHI '18), 1–14. https://doi.org/10.1145/3173574.3173818

[83] John S. Seberger and Geoffrey C. Bowker. 2021. Humanistic infrastructure studies: hyper-functionality and the experience of the absurd. *Information, Communication & Society* 24, 12: 1712–1727. https://doi.org/10.1080/1369118X.2020.1726985

[84] Phoebe Sengers. 2011. What I learned on Change Islands: reflections on IT and pace of life. *interactions* 18, 2: 40–48. https://doi.org/10.1145/1925820.1925830

[85] Phoebe Sengers, Kaiton Williams, and Vera Khovanskaya. 2021. Speculation and the Design of Development. *Proc. ACM Hum.-Comput. Interact.* 5, CSCW1: 121:1-121:27. https://doi.org/10.1145/3449195

[86] Sarah Sharma. 2014. *In the Meantime: Temporality and Cultural Politics*. Duke University Press.

[87] Sarah Sharma. 2022. Undisciplined Time Studies. *Time & Society* 31, 1: 44–47. https://doi.org/10.1177/0961463X211073551

[88] Katie Shilton. 2013. Values Levers: Building Ethics into Design. *Science, Technology, & Human Values* 38, 3: 374–397. https://doi.org/10.1177/0162243912436985

[89] Jesper Simonsen, Helena Karasti, and Morten Hertzum. 2020. Infrastructuring and Participatory Design: Exploring Infrastructural Inversion as Analytic, Empirical and Generative. *Computer Supported Cooperative Work (CSCW)* 29, 1: 115–151. https://doi.org/10.1007/s10606-019-09365-w

[90] Daniel Snow and Marguerite Barry. 2024. Data After Life: A data donor card to provoke questions concerning post-mortem data use. In *Companion Publication of the 2024 ACM Designing Interactive Systems Conference* (DIS '24 Companion), 149–152. https://doi.org/10.1145/3656156.3663726

[91] Daniel Snow, Conor Linehan, Sarah Robinson, Alejandra Gómez Ortega, Joseph Lindley, Fiona McDermott, Benjamin R. Cowan, and Marguerite Barry. 2025. Six Degrees of Speculation: Towards a Taxonomy of Temporality. In *Companion Publication of the 2025 ACM Designing Interactive Systems Conference*. Association for Computing Machinery, New York, NY, USA, 64–67. https://doi.org/10.1145/3715668.3734169

[92] Bernd Carsten Stahl, Michael Obach, Emad Yaghmaei, Veikko Ikonen, Kate Chatfield, Alexander Brem, Bernd Carsten Stahl, Michael Obach, Emad Yaghmaei, Veikko Ikonen, Kate Chatfield, and Alexander Brem. 2017. The Responsible Research and Innovation (RRI) Maturity Model: Linking Theory and Practice. *Sustainability* 9, 6. https://doi.org/10.3390/su9061036

[93] Susan Leigh Star. 1999. The Ethnography of Infrastructure. *American Behavioral Scientist* 43, 3: 377–391. https://doi.org/10.1177/00027649921955326

[94] Susan Leigh Star and Karen Ruhleder. 1994. Steps towards an ecology of infrastructure: complex problems in design and access for large-scale collaborative systems. In *Proceedings of the 1994 ACM conference on Computer supported cooperative work* (CSCW '94), 253–264. https://doi.org/10.1145/192844.193021

[95] Rosemary Steup, Paige White, Lynn Dombrowski, and Norman Makoto Su. 2022. "A Reasonable Life": Rhythmic Attunement and Sustainable Work at the Intersection of Farming and Knowledge Work. *Proc. ACM Hum.-Comput. Interact.* 6, CSCW2: 476:1-476:22. https://doi.org/10.1145/3555577

[96] Janna Thompson. 2013. Being in Time: Ethics and Temporal Vulnerability. In *Vulnerability: New Essays in Ethics and Feminist Philosophy*, Catriona Mackenzie, Wendy Rogers and Susan Dodds (eds.). Oxford University Press, 0. https://doi.org/10.1093/acprof:oso/9780199316649.003.0007

[97] Nigel Thrift. 2016. The University of Life. *New Literary History* 47, 2/3: 399–417.

[98] Laia Turmo Vidal, Ana Tajadura-Jiménez, and Judith Ley-Flores. 2025. Temporal Trajectories: Characterizing Somatic Experiences that Unfold Over Time. In *Proceedings of the 2025 ACM Designing Interactive Systems Conference* (DIS '25), 2931–2949. https://doi.org/10.1145/3715336.3735777

[99] Filip Vostal. 2016. *Accelerating Academia*. Palgrave Macmillan UK, London. https://doi.org/10.1057/9781137473608

[100] Judy Wajcman. 2016. *Pressed for Time: The Acceleration of Life in Digital Capitalism*. University of Chicago Press, Chicago, IL. https://press.uchicago.edu/ucp/books/book/chicago/P/bo19085612.html

[101] Judy Wajcman. 2019. How Silicon Valley sets time. *New Media & Society* 21, 6: 1272–1289. https://doi.org/10.1177/1461444818820073

[102] Judy Wajcman and Nigel Dodd. 2016. *The Sociology of Speed: Digital, Organizational, and Social Temporalities*. Oxford University Press.

[103] Russell West-Pavlov. 2012. *Temporalities*. Routledge, London. https://doi.org/10.4324/9780203106877

[104] Mikael Wiberg. 2025. *Fast and Slow: Methods for Timely HCI and Interaction Design Research*. CRC Press.

[105] Mikael Wiberg and Erik Stolterman. 2021. Time and Temporality in HCI Research. *Interacting with Computers* 33, 3: 250–270. https://doi.org/10.1093/iwc/iwab025

[106] David Gray Widder, Derrick Zhen, Laura Dabbish, and James Herbsleb. 2023. It's about power: What ethical concerns do software engineers have, and what do they (feel they can) do about them? In *Proceedings of the 2023 ACM Conference on Fairness, Accountability, and Transparency* (FAccT '23), 467–479. https://doi.org/10.1145/3593013.3594012

[107] Richmond Y. Wong, Vera Khovanskaya, Sarah E. Fox, Nick Merrill, and Phoebe Sengers. 2020. Infrastructural Speculations: Tactics for Designing and Interrogating Lifeworlds. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (CHI '20), 1–15. https://doi.org/10.1145/3313831.3376515

[108] Richmond Y. Wong, Michael A. Madaio, and Nick Merrill. 2023. Seeing Like a Toolkit: How Toolkits Envision the Work of AI Ethics. *Proc. ACM Hum.-Comput. Interact.* 7, CSCW1: 145:1-145:27. https://doi.org/10.1145/3579621

[109] Richmond Y. Wong and Tonya Nguyen. 2021. Timelines: A World-Building Activity for Values Advocacy. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (CHI '21), 1–15. https://doi.org/10.1145/3411764.3445447

[110] Shuer Zhuo and Jiaying Liu. 2025. Digital Boundaries of Time: Exploring How Calendar App Designs Mediate Time Perceptions and Boundary Management. In *Companion Publication of the 2025 Conference on Computer-Supported Cooperative Work and Social Computing* (CSCW Companion '25), 452–459. https://doi.org/10.1145/3715070.3749269

[111] Ahmed Ansari (2015) Design Must Fill Current Human Needs Before Imagining New Futures. MIT Media Lab Summit | PDF | Science. *Scribd*. Retrieved January 8, 2026 from https://www.scribd.com/document/654367314/Ahmed-Ansari-2015-Design-must-fill-current-human-needs-before-imagining-new-futures-MIT-Media-Lab-Summit

[112] Young, I.M., 2006. Responsibility and global justice: A social connection model. *Social philosophy and policy*, *23*(1), pp.102-130.