

“A Reasonable Life”: Rhythmic Attunement and Sustainable Work at the Intersection of Farming and Knowledge Work

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Past CSCW work has examined the role of temporal rhythms in cooperative work and has identified alignment work—the work required to bring dissonant rhythms into alignment—as an important aspect of large-scale collaboration. We ask instead how individual workers interact with temporal rhythms to sustain the conditions that make their work possible—not aligning rhythms, but attuning them. This paper draws on interviews with farmer-knowledge workers, people who engage with both farm work (the work of growing food or raising animals for food, on a commercial or non-commercial basis) and computer-based knowledge work. We identify three ways that farmer-knowledge workers interact with natural and structural rhythms to construct sustainable work-lives: anchoring (tying oneself to a particular rhythm to create accountability and structure), decoupling (loosening or cutting ties with a rhythm to create flexibility), and gap-filling (interweaving complementary rhythms to create balance). Together, these practices constitute attunement work.

CCS Concepts: • **Human-centered computing** → **Collaborative and social computing theory, concepts and paradigms**; **HCI theory, concepts and models**; **Empirical studies in HCI**; **Empirical studies in collaborative and social computing**.

Additional Key Words and Phrases: time, rhythm, attunement, farming, agriculture, knowledge work, busyness, values, ethnography

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1 INTRODUCTION

Temporal rhythms and temporal coordination are long-standing topics in CSCW, with past work covering the role of temporal rhythms in information-seeking [40, 49, 50], scientific collaboration [24, 55], and even holiday celebrations [31]. Frequently, researchers have focused on the work that must be done to align or synchronize rhythms within a large project or a complex system such as a hospital. There is less work exploring how individual workers relate to rhythms as part of their efforts to live fulfilling, “balanced” lives.

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In this vein, Leshed et al. [28] connected temporal rhythms to work/home coordination in a study of farming families who consciously blend home and work on the farm. They found that a key challenge for these families was aligning or synchronizing the natural rhythms of farm life with externally imposed, structural rhythms such as the timing of farmers' markets, children's school, and social events. Seen this way, the farm families are similar to the remote island and coastal towns studied by Vannini [61]. Life in these places has a different rhythm from life in mainland cities, and being "in time" on an island means being "out of time" with respect to the mainland. Despite their desire to disconnect from the mainland and be "in time," island residents must go to the mainland to access jobs, medical care, essential supplies, amenities, and air transportation; and when they do, they must interface with mainland/city time. Leshed et al.'s farm families similarly must accommodate to the rhythms of the world outside the farm/home.

It might seem natural that farm families—especially small-scale farmers—would want to disconnect from mainstream temporalities, because farming is culturally associated with natural rhythms and a slower, more relaxed pace of life. In this cultural imaginary, the slow pace of farm life is enabled, in part, by the absence of technology. Small-scale farmers and homesteaders often express an ambivalence towards modern technology, going "off-grid" as far as possible in some cases, or choosing to use low-tech/"traditional" farming methods that align better with their values with respect to sustainability, ethical treatment of animals, etc. Technology is commonly associated in the Western cultural imagination with time pressure and speed-up, so rejection or selective use of technology can be part of people's efforts to live more "slowly" [53, 63]. Nevertheless, some people combine farming, gardening, or homesteading with highly technical vocations that are associated with the world of 9–5 work and fast-paced, busy lifestyles. They include farmers who use and develop software tools as part of their farming; farmers who do remote knowledge work, unrelated to the farm, as a secondary job; and software developers and engineers who farm or garden in addition to their primary job. These hybrid farmer-knowledge workers do not reject technology; nor do they want to disconnect entirely and be "out of time." Yet they also choose to be connected to farm work and its temporal rhythms, despite having the resources to make different choices.

Our paper explores the experiences of people at this intersection of high-tech work and farming. We conducted qualitative interviews with 18 people who engage in both farm work (the work of growing food or raising animals for food, on a commercial or non-commercial basis) and computer-based knowledge work. We build on Leshed et al.'s [28] observations about natural and structural rhythms, but we look beyond synchronization to describe other ways people relate to temporal rhythms, and how disparate rhythms can be *resources* as well as challenges. In the spirit of Wajcman's call to "reimagine hybrid sociomaterial assemblages or networks for enacting different times in an intensely technological world" [63] (p. 176), the research questions for our study were: What alternative or variant temporalities emerge at the intersections of these different and seemingly incompatible work cultures (knowledge work and farming)? How do people at this intersection create sustainable work-lives that align with their values? And how can their practices open up possibilities in the design of work support tools?

We find that the hybrid farmer-knowledge workers in our study negotiate between natural rhythms and the structural rhythms of 9–5 work, using these rhythms as resources to craft sustainable routines. We identify three practices that our participants engaged in: anchoring, decoupling, and gap-filling. We characterize these practices as forms of *attunement work*, a complement to Jackson et al.'s alignment work in CSCW [24]. Whereas alignment work addresses the need to bring disparate rhythms into workable alignment in collaborative projects, attunement work speaks to the ways individuals relate to rhythms in their work-lives. As a theoretical lens, attunement work shifts from a task-oriented, organizational, and conflict-averse perspective of rhythms to one that is more personal, affective, and messy. The goals of attunement work are not necessarily to

accomplish work but to sustain work. Broadly, we will show that attunement work—beyond our specific population of farmer-knowledge workers—provides an alternative way in CSCW to think about time-related values and assumptions in the design of work support technologies.

2 RELATED WORK

In this section, we survey CSCW and related literature on values in the design and use of agricultural technologies; work-life balance and boundary management; and temporal rhythms in work. We argue that values such as efficiency associated with work support technologies are not monolithic, but are defined in various ways by users. For our participants, living and working in accordance with their values is key to *sustainable work*, a more holistic alternative to “work-life balance”. Temporal rhythms—in particular, the natural and structural rhythms associated with farming and knowledge work—are resources that our participants use to accomplish their values and work sustainably.

2.1 Farmers’ technology use and values

Values are embedded in work-support technologies; for instance, Mazmanian et al. [37] and Wajcman [64] describe how scheduling apps perpetuate their designers’ orientations to and moral judgments about time use. The affordances and limitations of technologies constrain people’s practices, enforcing normative modes of work. Accordingly, HCI has dedicated a lot of attention to technology design as a critical site in which values are materialized and reinforced. Scholars and designers have developed and honed methods such as value-sensitive design (VSD) [15, 17] to support mindful discussions of values during the design process. Similar to the conceptual and empirical investigations of VSD’s tripartite methodology, our work attempts to tease out the values implicated by the social practices of farmer-workers and the artifacts they use.

But as many scholars have pointed out, values-oriented design is not a straightforward process of “identifying and applying” values [25]. Values may be in tension with other values or competing goals, or there might be multiple ways (and thus disagreements about how) to work towards values [62]. Values are enacted within larger social, economic, legal, and political systems, all of which constrain how people can express their values. Moreover, people’s values (and their expressions of those values) are not static but can and do change over time. Some values scholarship addresses the interaction of values and technologies after design, e.g. values in use [2] and values in repair [22]. This thread of research approaches “values as contingent and ongoing accomplishments” [22] that are not fully fixed or determined [9] in design but rather negotiated between technologies and communities of users.

Past HCI and CSCW work on farming has often focused on surfacing the values of farming communities—usually non-mainstream communities such as urban farmers [8, 34, 43]; small, direct-to-consumer farms [28, 57]; rural smallholders [12, 21, 29]; and permaculture practitioners [33, 42]. This past work explicitly or implicitly compares farmers’ values to the values embedded in existing technologies to identify gaps and conflicts. Based on a survey of data-driven farming products being marketed to farmers, Steup et al. [56] find that advertising for data-driven farming tools emphasizes efficiency and control. They raise concerns about how these tools might affect power relationships between agricultural stakeholders, including between farmers and technology providers and between farmers and the ecosystems they care for, if these values are prioritized over others, such as care. Liu et al. [33] argue that HCI should approach sustainability through the permaculture philosophy of care for and connection with nature, rather than the more traditional “control paradigm.” Researchers also point to conflicts between some farmers’ commitment to environmental sustainability and the negative environmental impacts of computer and other

technologies; and between the high value farmers place on in-person interaction, and technologies that are designed for intense or prolonged engagement [39, 42].

Our work's contribution does not lie in definitively labeling the values of our participants [9, 27], but rather in describing how our participants seek to realize values through negotiation of temporal rhythms. While past CSCW work on farming points to conflicts between farmers' values and the values embedded in software tools, our findings suggest nuance within these conflicts. Consistent with an understanding of values as ongoing and contingent accomplishments, we find that our participants have complicated and shifting relationships with values like "efficiency" that are associated with many work support tools, including data-driven farming tools. Far from rejecting efficiency, many of our participants embraced it—but in doing so, they did not embrace a productivist model of farming. Efficiency was, instead, a means to direct their time to valued activities as part of achieving a "balanced" or sustainable work-life.

2.2 From work-life balance to sustainable work

The concept of "work-life balance," as a measure of workers' well-being, is widespread in self-help literature targeted at knowledge workers [18] and in the cultural consciousness of knowledge workers. The premise of work-life balance is that "work" (usually paid work) should not dominate a person's time to the exclusion of "life"—an amorphous category encompassing everything outside "work," often understood to mean the responsibilities of caring for a family [51]. An unsustainable situation arises if either work or life demands too much of a worker's time; their performance in the other domain may suffer, and they will experience stress.

Despite its popularity, work-life balance has been criticized on the grounds that it presents a reductive view of both "work" and "life". Discussing "the work-life balance debate," Ruth Eikhof [51] argues that it revolves around "a number of questionable assumptions and perceptions: that work is experienced as negative, with long working hours a particular problem; that 'life' can be equated with caring responsibilities, most particularly childcare, with the result that women are the primary target of work-life balance provisions; and that work and life are separable and in need of being separated." In the self-help literature, as well, some authors reject this separation of work and life; for instance, David Allen's influential book *Getting Things Done* embraces a broad definition of work that does not distinguish between "work" and "personal" tasks [1] (p. 4). The "balance" Allen promises to help his readers achieve is a general feeling of equilibrium—a flow state in which one is relaxed, in control, engaged, and productive; the opposite of being "out of control, stressed out, unfocused, bored, and stuck" (p. 10-11). We define *sustainable work* along similar lines, to mean working in a way that preserves one's physical and mental health and one's enthusiasm for the work—part of which is working in accordance with one's values.

Related to work-life balance, some scholars have examined the relationship between "work" and "home" as sociocognitive realms [41] or domains [13], leading to a focus on *boundaries* between these realms. Boundary theory proposes that the realms of work and home, and their corresponding roles, can be integrated (temporally and spatially commingled) or segmented (relegated to separate times and/or spaces) to different degrees [41]; or in other terms, the boundaries between them have different degrees of flexibility and permeability [4, 13]. With respect to undergraduate students—a group for whom "work" and "home" are less clearly defined—Lim et al. introduce the more general concept of "life spheres," which include "not only academia but also social, family and extracurricular spheres"—although they maintain a kind of "boundary" between "school domains" and "non-school domains" that parallels the traditional work/life dichotomy [32].

Boundaries are not fixed once and for all but constantly shaped and reshaped, and people naturally enroll technologies in the project of boundary maintenance. For example, studies on how workers interleave interactions with their private lives during the day with information technologies [5, 59]

establish that, while workers are constrained in how they manage their rhythms, they nonetheless exert some agency in shaping their own rhythms to achieve some balance between work and non-work domains. Moreover such studies establish that workers weave less structured tasks (e.g., those involving ad-hoc communications or care work) into and around sometimes rigid temporal structures (e.g., meetings, work/school schedules). Work-home or work-life boundaries, and the role of technology in negotiating these boundaries, have thus been a productive area of study in CSCW and HCI.

In this paper, we explore an alternative to boundaries for understanding how people balance and coordinate different aspects of their work-lives. Some of our findings resonate with the above work on boundary management: for instance, Clark finds that “a mixture of distinctly different activities gives variety and excitement” to the lives of people who segment work and home, “and regular breaks that one domain provides from the other allow individuals to renew their energy” [13]. We see similar dynamics play out in our participants’ mingling of farm work and knowledge work. However, we examine these practices through the lens of temporal rhythms and focus on how disparate rhythms enable this kind of alternation in support of a more sustainable life. Past HCI work on boundaries has acknowledged that “work” cannot be neatly separated from “life” [7, 19]—especially for populations, such as remote or nomadic workers [16, 52], undergraduate students [32], and farmers [28], for whom research shows work and home are collocated and intermingled. In looking beyond boundaries, we hope to move even further from work-life balance and the problematic assumption that work is, or should be, separable from the rest of life. Rather than conceptualizing our participants’ lives in terms of spheres or domains, we focus on the temporal rhythms that they engage with and how they use these rhythms to create sustainable work arrangements.

2.3 Temporal coordination and rhythms

A significant body of CSCW research has studied the role of rhythms in temporal coordination of work. For these purposes, rhythms are defined as temporal patterns that recur in a work setting. Rhythms operate at all scales, from the small and personal (labor contractions [47]) to the more-than-human (the slow, cyclical processes by which soil is renewed [48]). In any given work context, a wide variety of rhythms interweave. Researchers have proposed various taxonomies for classifying rhythms according to scale, origin, and roles. In a study of Danish home care workers, Nilsson and Hertzum [40] distinguish between individual, collective, and social rhythms: individual rhythms are associated with a specific person; collective rhythms arise from the interaction of individual rhythms; and social rhythms are moments of collocated social interaction among workers. Jackson et al. [24] define four categories of rhythms in large-scale, collaborative research: organizational (imposed by the organizations or institutions governing research), infrastructural (limitations and needs of the built environment), biographical (life circumstances of individual workers), and phenomenal (driven by the objects and processes being studied). For their study of farming families, Leshed et al. [28] adapt and condense these categories into two, natural and structural rhythms, where “natural” refers to rhythms that originate within the farm/family and “structural” refers to rhythms of social and commercial life beyond the farm. We also use these terms to distinguish between rhythms that are driven by natural processes and those that are socially constructed (with the awareness that there is ambiguity between these categories).

Much of this past research focuses on the need to synchronize or align disparate rhythms to accomplish work goals. In Jackson et al.’s research on large-scale scientific projects, scientists have to reconcile the phenomena they are studying—processes with very long and/or unpredictable time scales—with the much shorter operating cycles of funding agencies [24]. Jackson et al. define *alignment work* as “the complex set of actions and activities required to bring otherwise

disparate rhythms into heterogeneous and locally workable forms of alliance.” A follow-up paper by Steinhardt and Jackson [55] explores the role of plans as a tool for accomplishing alignment work. Bruyninckx [10] theorizes *synchronization* as a form of invisible repair work: in a laboratory setting, synchronization is the improvisational work that technicians do to prevent and resolve slippages between organizational rhythms (schedules and policies imposed by administration) and instrumental rhythms (material conditions of scientific instruments and their use). Leshed et al. [28] found that synchronizing natural rhythms and structural rhythms is a major challenge for farm families who blend home and work. A key strategy is “to align the structured activities to fit the natural rhythms, and vice versa.” For instance, they align their (homeschooling) school year with the growing season, and time harvesting so as to have produce ready for market rather than harvesting every crop at peak ripeness [28]. Leshed et al. suggest that, rather than a unique challenge of farm families, the need to synchronize natural and structural rhythms is an understudied aspect of family coordination generally.

From another perspective, rhythms are a resource that workers use to create structure and predictability in their work day. Reddy and Dourish [49], studying information-seeking behavior among hospital workers, describe how workers’ knowledge of rhythms (such as nurses’ shift changes, physicians’ rounds, and the processing of lab tests) allows them to anticipate when they will need information and when it will be available. Nilsson and Hertzum [40] similarly portray rhythms as an asset to home care workers in coordinating their distributed work. A worker’s weekly schedule of home visits, which is largely consistent from week to week, constitutes “a background structuring against which changes are readily noticed” and adaptations made. The schedule is formally specified, but it is also internalized as tacit knowledge by the workers who learn the best routes to travel on their rounds and become familiar with the routines of their regular clients and coworkers. As with Reddy and Dourish’s hospital workers, this knowledge helps the home care workers plan and smoothly accomplish their work. We align more with this perspective on rhythms, which looks at how individuals relate to and use rhythms rather than how rhythms are aligned in a collaborative effort.

In the following sections, we describe related work on the rhythmic characteristics of farm work and knowledge work. While both types of work involve a variety of natural and structural rhythms, *natural rhythms* are most salient in agriculture, while structural rhythms—particularly those of the 9–5 job—dominate in knowledge work.

2.3.1 Rhythms in agriculture. Agricultural work has its own unique set of rhythms, largely defined by natural processes and independent of clock time. Inhetveen [23] describes the work of women on rural farms as being structured by many overlapping, cyclical rhythms of organic growth; the overlapping of these rhythms creates periods of intense time pressure and periods where not much is happening, resulting in an “alternation of effort and relaxation.” She also argues that because their work-lives are so ruled by natural rhythms, time for these women “is constituted in a more concrete, contextual and qualitative as opposed to an abstract, decontextual, mathematical way.” E.P. Thompson, in a canonical essay on orientations to time under capitalism [60], contrasted industrial capitalism’s adherence to clock time with the “task-orientation” of subsistence farmers and fishers. For a peasant farmer, “the day’s tasks...seem to disclose themselves, by the logic of need”; natural processes, rather than abstract time, structure the farmer’s work. Because self-employed farmers have a relatively high level of temporal autonomy [63], they can also shape their work routines around human biographical and biological rhythms: for instance, Leshed et al.’s findings include the observation that “the flexibility of farm life allows people to follow their own personal natural rhythms,” such as being a morning person or a night owl [28].

However, farms must still engage with structural rhythms. Farmers who sell their produce have to interface with other businesses and organizations that have their own schedules (processing facilities for meat; farmers' markets, grocery stores, and restaurants; organic certifiers; and so on), and this presents organizational challenges [28, 57].

2.3.2 Rhythms in knowledge work. In contrast with farming, knowledge work tends to be associated with the structural rhythms of the 9–5 (or 8–5) work day, the 5-day work week, etc. This type of work often exists, as Sharma observes, “within the auspices of what is most often conceived of as the most normal time, the most structured of temporalities [...] the nine-to-five job” [53]. The nine-to-five provides structure to a type of work that seems to have few natural constraints. Compared to farm work, computer-based work is largely independent of day/night cycles, weather, and seasons. This is even more true for remote knowledge work, because it eliminates the need to commute, with its potential complications (breakdowns, transit strikes, missed connections, inclement weather). Accordingly, CSCW research on rhythms in knowledge work tends to focus on social rhythms such as those within work teams. For instance, Begole et al. [6] posit that in remote/distributed knowledge work where teams are not collocated (and may not be in the same time zone), coworkers can't learn each other's rhythms and thus are deprived of that resource; specifically, this lack of awareness is a barrier to efficient communication. They prototyped a visualization to create a “social sense of time” without physical copresence by revealing individuals' rhythmic patterns of availability. Koehne et al. [26] describes how remote team members adjust their rhythms around those of the physical office—the need to plan one's days carefully, accommodate last-minute changes made by collocated colleagues, and work at odd times if there is a time zone disconnect.

In reality, of course, knowledge work is not fully independent of natural rhythms, because humans are part of nature. Nine-to-five work cultures often struggle to accept and incorporate the fact that people's capacity for work is not constant; it fluctuates and can be affected by mental or physical illness, stress, competing responsibilities and interests, etc. But beyond these contingencies, knowledge work has its own, natural rhythm. One key aspect of this is that progress on creative tasks requires sustained focus. In a workplace ethnography focused on software developers, Perlow [46] observes that one of the most important factors in the developers' productivity was the ability to create interruption-free periods of time for focused work. Other studies have affirmed the importance of making time for focused work and the counter-productive effect of context switching. For instance, Mark et al. [36] performed an experiment in which 13 information workers abstained from email for 5 workdays. Their findings suggest that email use contributed to an accelerated work pace and work fragmentation; without email, people were able to focus longer on work tasks. Efforts have also been made to measure workers' attentional states and how they change over the course of the work day and week [35].

Our data affirm many of these findings about the rhythmic characteristics of agricultural and knowledge work. But our paper is unique in that it focuses on the temporal practices of people at the *intersection* of these two kinds of work. We find that the disparate rhythms of farming and knowledge work complement each other in unexpected ways, and that when they do conflict, that conflict can be generative.

3 METHODS

The goal of this project was to explore the experiences and practices of people at the intersection of farming and software development. Because they are engaged in two types of work with very different temporal patterns, and because they have a relatively high degree of temporal autonomy, this group represents an information-rich case [45] (p. 242) for studying work-life coordination.

Participant Pseudonym	Gender	Involvement in Farming	Involvement in Knowledge Work
James	Man	Helps on Family Farm	Engineering*
Erin	Woman	Farm Owner-Operator*	Video Production
Leah	Woman	Farm Owner-Operator*	Nonprofit Director
Alex	Man	Farm Employee	Farm-Related Data Management
Martin	Man	Farm Owner-Operator*	Computational Research
Anthony	Man	Farm Owner-Operator	Farm-Related Data Management
Daniel	Man	Farm Manager*	Software Development (hobby)
Nina	Woman	Gardening	I.T. Project Management*
Zach	Man	Volunteer Worker*	Software Development (hobby)
Emily	Woman	Farm Owner-Operator	Scientific Coordinator*
Chris	Man	Farm Owner-Operator	Software Development*
Luke	Man	Farm Owner-Operator	Software Development*
Isaac	Man	Farm Employee (former)	Software Development*
Joshua	Man	Gardening	Software Development*
Travis	Man	Farm Employee (former)	Software Development*
Rob	Man	Gardening	Software Development*
Jesse	Man	Gardening	Software Development*
Sam	Man	Gardening	Software Development*

Table 1. Table of research participants. In columns 3 and 4 ("Involvement in Farming" and "Involvement in Knowledge Work"), an asterisk indicates the participant's primary work area in terms of time commitment. Where there is no asterisk, it means that the participant's farm work and computer-based knowledge work are part of the same job.

We therefore reached out to people who had a primary career of either software development or farming, with a hobby or involvement in the non-primary. Later, we expanded our scope to include other kinds of computer-based knowledge work (engineering, computational research, etc.) We deliberately recruited a diverse group of participants, including some who are primarily farmers and others who are primarily knowledge workers. The nature of their farm work varies widely: for some, "farm work" consists of tending a large backyard garden; for others, raising livestock on pasture; for still others, growing row crops on 2000 acres. They also vary in terms of how integrated their farm work and knowledge work are with each other: at one extreme, the knowledge work arises from the needs of the farm (e.g. a farmer using and developing software to manage farm-related data); at the other extreme, farming and knowledge work are part of separate realms (e.g. a software developer growing and selling food in their "free" time). The common element is the *intersection* of these two types of work in participants' lives.

This project was inspired by and builds upon our previous ethnographic work with small-scale farmers [57]. Two participants in the included table were part of that previous work and did not participate in the present study. Leah participated in an earlier interview study; her quotes come from that interview. Chris supervised the first author during four months of participant observation as a volunteer worker on his small vegetable farm in summer 2019, at the end of which he participated in an interview. Both met the inclusion criteria for this project (involvement in both farming and computer-based knowledge work) and made relevant observations in their interviews, so they were added to the present data set. That period of participant observation also served as a catalyst for this project, both by sparking our interest in how people combine farm and computer work, and by providing the first author with a practical understanding of farm work

that enabled deeper conversations in interviews (because the interviewer was familiar with basic farming concepts and terms).

3.1 Interviews

Our main method was semi-structured interviews, which provided rich, qualitative data on people's experiences. Between January 2020 and October 2020, the first and second authors conducted 16 individual interviews. Interviews were conducted remotely via Zoom—initially because our participant pool was geographically dispersed, and later because the COVID-19 pandemic made in-person contact impossible. Participants were recruited primarily from FarmOS, an online community that uses and maintains open-source farm management software; as well as two other online communities, AgOpenGPS and GOATech; and Twitter. Additional participants were recruited through snowball sampling, with all participants being contacted via direct message on the respective forums or by email. The interviews lasted between 60 and 105 minutes. All interviews were recorded with the permission of the participant and later transcribed for further analysis. We analyzed transcripts using a grounded approach: open coding was done and codes were clustered to identify themes. The first seven participants were contacted again later with follow-up interview requests, as the interview protocol changed after they were initially interviewed. Of these participants that were contacted again for follow-up interviews, four responded, and interviews were conducted in June 2021.

The first interview protocol, used for the first seven interviews, was broad and exploratory. Questions related to identity, software development, software use, and community. After analyzing the first seven interviews, the theme of *balance* among different types of work emerged. The second interview protocol, used for the remaining interviews, focused on this theme. Questions were grouped into three categories: career narratives and identity, work routines, and technology. The interview protocol used for the follow-up interviews used questions off the second interview protocol, with questions for specific participants added on.

3.2 Card-sorting exercise

In the follow-up interviews, participants were asked to participate in a card-sorting activity using the virtual whiteboard tool Miro. The goal of this activity was to explore, and test the validity of, conceptual categories that had emerged from the previous interviews. Cards were created based on activities participants had discussed doing in their first interview (e.g. “debugging code,” “feeding chickens,” “watching kids”), with more cards being created by a research assistant during the follow-up interview. These activity cards were personalized for each participant. The participants were asked to group their cards into categories. A second set of cards was available to participants to use as inspiration for categories; these cards were based on adjectives participants had used to describe farm work or computer work, such as “flexible,” “creative,” “abstract,” and “physical”. All participants saw the same set of category cards. Participants were able to group their cards however they pleased, and were later asked to explain their thought process. This activity allowed us to think with our participants about qualitative differences within and between types of work.

4 FINDINGS

Our Related Work (Section 2) introduced “natural rhythms” and “the nine-to-five,” two categories of rhythms that are especially salient when comparing the temporalities of farm work and knowledge work. At the intersection of farm work and computer-based work, our participants felt the pull of two time regimes, one organized around natural rhythms (seasons, day/night, animal and plant life cycles) and the other, the 9–5 work world (8-hour work days, 5-day work weeks, evening social events). Farm work and computer-based knowledge work are both flexible and rigid in different

and complementary ways. Knowledge work is flexible in the sense that it is largely independent of environmental conditions and natural cycles; but it operates under the (sometimes quite rigid) structural constraints of wage labor and the 9–5 time regime, which designates certain times (roughly 8–5, Monday–Friday, year-round) as work time and expects workers to be consistently productive during those times. Conversely, farm work is flexible with respect to clock time and the 9–5, but it ties the farmer to natural rhythms that can be equally demanding.

The following sections will describe how people at the intersection of farm work and knowledge work interact with these two types of rhythms, sometimes playing them off against each other, in their efforts to create a sustainable work-life. In our data, we saw three practices related to rhythms: anchoring (making oneself accountable to certain rhythms), decoupling (reducing dependence on particular rhythms), and gap-filling (weaving together complementary rhythms).

4.1 Anchoring

Anchoring is when a person ties themselves closer to a (set of) rhythm(s), making it part of their routines. That rhythm becomes an anchor point around which other activities must be arranged. Anchoring provides structure and accountability in the face of uncertainty. To illustrate this theme, we describe a common example from our data: anchoring to the natural rhythms of farm animals as a way to balance the demands of time-greedy computer work.

In farm work, caring relationships with nonhuman animals provide ready anchor points to natural rhythms. Animals have needs that cannot be ignored or deferred. They have to be fed, watered, moved from one section of pasture to another; if housed indoors, they need soiled bedding to be replaced with fresh; dairy cows and goats need to be milked at regular intervals; and so on. These rhythms provide a certain structure and predictability to the day that some participants welcomed. “The work makes itself,” according to Daniel, instructor and farm manager on an educational farm: “it’s just responding to the natural rhythms that are around us, the seasons, the—whatever the goats are doing, whatever the cows are doing at that particular time or what the fields need or what the chickens need...” He said that it is good for his students to be exposed to the rhythms and routines of farm work—to be anchored to these rhythms—because it helps them develop a sense of rhythm and understand their place within larger natural and social systems. Implicitly, Daniel values groundedness for himself and his students.

Some participants anchored to animals’ rhythms as a way to maintain a desired routine by holding themselves accountable. Leah, a small-scale farmer who also works for a nonprofit, describes how her non-farm job provides a welcome excuse to rest from her physically demanding farm work: “I would say I’m in the best shape of my life [...] but at some point, I need a break. Um...and we get sore. And so the nonprofit work...is almost guaranteed to be sitting down. [...] So I can sit and have meetings, and I can sit and talk on the phone, and...I need that.” On the other hand, farming also involves computer work—accounting, marketing, research, etc.—and the needs of her animals help propel her back into motion and outside before the computer time becomes excessive: “And we could be on the computer all day, probably. The farm work is a good balance to it, that, y’know, you gotta go out and feed the animals three times every day.” In this example, anchoring (to the animals and their rhythms) supports a strategy of gap-filling, alternating mental and physical work. Rather than relying on willpower or arbitrary schedules to keep computer work in check, she is accountable to the animals. Similarly, being accountable to her job ensures that she will take some time for non-physical work.

For our participants who were primarily knowledge workers, working on a farm or garden was a way to make physical activity part of their day without setting aside time specifically for exercise. Physical work on the farm felt meaningful and satisfying in a way that “working out” did not. About mucking out her chicken coops, Anna said, “It’s very physical. So, I like feeling like this is

my—instead of going to the Y[MCA], I'm doing this and it's useful. I love it." Because it serves a purpose beyond exercise, such physical work cannot be put off as easily as a trip to the gym; it needs to be done regularly. For Sam, an engineer who before the COVID-19 pandemic had spent a lot of time in the shop, and now found himself spending a lot of time in online meetings, the desire to do more physical work was tied to his need for exercise: "I'm like not a, you know, some people are like runners, like they get up in the morning and they run and—I'm just not that, I need to have the physical activity as part of my daily work to get it in." He believed that being physically active was important to his health, but was unable to "make time" for it, as some people do, around his work; only by making it part of his work—tying it to an established and highly prioritized rhythm, the work day—could he be sure to get regular exercise. Overall, we see that anchoring makes it easier for our participants to support their values of a life that involves both physical and mental work.

4.2 Decoupling

Decoupling means weakening or limiting one's ties to a particular (set of) rhythm(s), becoming more independent of it. It is the flip side of anchoring: decoupling from one rhythm (e.g., conventional working hours) can facilitate anchoring to another (weather conditions that dictate when certain farm tasks can be done). Or vice versa: anchoring to one rhythm can lessen the demands of another. Analytically, we find it helpful to make this distinction because they have different objectives—whereas anchoring creates structure, the goal of decoupling is to increase flexibility. This section describes how two farmer participants decoupled from natural rhythms: in one case, by using labor-saving technology; in the other, by anchoring to 9–5 work.

As discussed above, caring for farm animals locks one into certain routines. While this can be a desirable source of structure and accountability, it can also feel oppressive. It can put farmers out of sync with other, social rhythms; Leah described having to explain to friends, for example, "why we...can't come to the party, because we have to do evening chores." The farmer is not only anchored to the animals' rhythms, they are physically anchored to the farm, in the sense that it is hard to leave the farm untended for any length of time. Anthony, a small-scale livestock farmer engaged with the open source software community, described the lack of flexibility he saw on other farms: "Everybody else who has chickens, they're out there at sunrise, to open a door. They're out there at sunset to close the door. If the door's not closed at sunset, there's a potential predator problem. If it's not open early enough, you're now confining your chickens into a small housing. It really puts a framework on... 'Hey, I gotta leave whatever I was doing, drop everything and run over and close up my chickens.'" Anthony had installed automatic feeders and doors on his farm, which made his work schedule less dependent on sunrise/sunset and removed the need to feed the animals at specific times; using automation, he decoupled his routines from the biorhythms of his animals and the phenomenal rhythm of sunrise and sunset. Those adaptations enabled Anthony to have what he called "a reasonable life," one in which he has flexible work hours and can "get away" from the farm for up to a day at a time without worrying about his animals. Decoupling allowed him to balance his values of flexibility and care for his animals.

For Emily, a knowledge worker who is actively involved in farming, decoupling meant limiting her accountability to each work domain. Her story is an example of how anchoring (to the structural rhythm of 9–5 work) can support decoupling (from potentially endless farm work driven by natural rhythms). Emily leverages the 9–5 rhythms against the insatiable demands of farm life to give herself flexibility. She has a full-time, work-from-home job in research administration. She also runs a small farm with her husband on the land where they live. Emily likes having a 9–5 job because she values clear boundaries. She did not seek an academic career after finishing graduate school because she perceived that academia was "more like a lifestyle than a job"; it required a

“commitment” and “level of dedication” that she was not comfortable with. She said that she was passionate about her research but wanted to be able to do other things as well, whereas in an academic job she would have to make the job her life and be “always working on” it. In such a career (she felt), it would be too difficult to maintain uncommitted time, time in which she was not accountable to her academic work. Her current job, she says, is restricted to certain times: “you do it for eight hours a day, you don’t do it on the weekends, nobody calls you after hours, and you’re done.” Like academia, farming has the potential to become an all-consuming “lifestyle”; Emily has so far avoided this, in part by anchoring to the 9–5 world through her job. With respect to the farm, she has given herself the role of “secondary farmer” (her husband being the primary farmer), which allows her to distance herself from the farm as needed. She works on the farm, but on any given day, it is a choice for her rather than an obligation. Her husband knows that she is unavailable during certain hours because of her job, and if she needs to relax with a book after her work day instead of going out to help with the animals, she can. She is ambivalent about whether she would be willing to make farming a lifestyle if she were to quit her job and farm full-time. She said she is willing to do farm work outside of normal (8–5, Monday–Friday) work hours because she is “emotionally invested” in it and because the nature of farming doesn’t allow it to be contained within specific hours. But she also said that the desire “to have boundaries around things and...not work all the time” is “a very fundamental part of [her]”. It is important to Emily to maintain her autonomy and not be subsumed by any one role (researcher, farmer, etc.). Her connection to the 9–5 work world and its rhythms (along with her husband’s willingness to fulfill the “primary farmer” role) helps her to decouple from the natural rhythms of farming which otherwise do not respect individuals’ boundaries.

4.3 Gap-filling

The third practice we identified, gap-filling, is supported by the first two (anchoring and decoupling). It enables, and is enabled by, the way our participants blend farm work with computer-based knowledge work. Both knowledge work and farm work have natural gaps—times when continuing to work is impractical or yields diminishing returns, whether because of environmental conditions (e.g. you can’t weed your fields because the soil is waterlogged from a recent rain) or due to fatigue (physical or mental). Gap-filling means alternating or blending the two types of work so a gap in one is filled by the other, creating balance between them—similarly to how people who segment work and home may find pleasure and relief in moving between these domains [13]. In a cultural context that discourages unproductive down time, gap-filling makes work sustainable by enabling productive rest and limiting unproductive (and therefore unsatisfying) work.

Looked at through the lens of time management, gap-filling can be a strategy for making the most of finite time, thereby supporting dominant market values around efficiency and productivity [54, p.138]. Especially for those who farm on a commercial basis (rather than purely as a hobby), the combined load of farm work and knowledge work can be intense. Whichever mode of work is secondary may have to be fit into the gaps of the primary mode because there is no other, spare time in which to do it. Martin said of working on his PhD dissertation while also running a farm: “it’s literally when I get a gap, do a bit of that [dissertation writing] and that’s just how it goes, it’s a slow process, that thing just ticks and ticks and ticks, little bit at a time...” Conversely, Chris, whose main income came from software development, was limited in what hours he could devote to farm work. His flexible work schedule and working remotely allowed him to do spend the better part of most mornings on the farm; but for the middle part of the day, he had to be “at” his software job, with excess farm work squeezed into nights, weekends, and holidays. In the context of time scarcity, making use of gaps can be a necessary survival strategy.

However, our research questions were not about how people *manage* to do both farming and knowledge work, nor how they cope with the demands of both. The questions had more to do with *why* they do both, given that most or all of our participants are in the privileged position of being able to choose; they could do knowledge work only and be financially secure. Given this, we argue that gap filling is more than a survival strategy; it is a practice that takes advantage of the ways in which knowledge work and farm work complement each other. It is a way of managing tensions that exist within each set of rhythms (natural and 9–5).

4.3.1 Managing tensions with 9–5. As alluded to above, the actual rhythm of creative knowledge work such as software development does not always match up with the rhythm imposed by a traditional, 9–5 work schedule. This mismatch creates gaps that can be filled by weaving together farm work and knowledge work. Jesse and Isaac (software developers), and James (engineer) all described the phenomenon of being stuck on a programming problem, unable to make headway until they took a break. In their stories, the problem was easily solved when they returned to it the following morning; in Jesse’s case, “I spent pretty much like half of the day trying to figure it out [...] couldn’t figure it out and it was like alright, log off for the day, do whatever. The following morning I got, you know, logged in, started typing, and then boom, I had it within like 30 minutes to an hour.” He credited this breakthrough to being “fresh in the morning” and having spent time doing other things: he was “able to come up with a solution because of the fact I was able to do something different instead of just trying to continue to hammer at it till I got it”. During the workday, however, they felt compelled to keep “hammering” at the problem because they were expected to work during certain hours. James told us about one such instance in which he stayed at the computer, working on a problem, but saw little value in doing so: “it was just one of those things you wish you could just put down and walk away from, but that was in my work hours, cause, you know, to deliver a project and it has to be done, so you have to just kinda struggle through, even though you could literally put it away for an hour, come back in an hour, and be as far on as you would have been just sat there trying to figure it out.” James believed that if he had taken a break, it would not have hurt his productivity; he would have gotten to the solution at the same time regardless of how he spent that hour (that potential gap). Both James and Jesse said they would like to have the freedom to walk away from situations like this, to fill the gap with other kinds of work and come back to the problem with a fresh perspective.

Given the flexibility to do so, weaving together farm work with knowledge work can ease this tension between natural work rhythms and the 9–5. Routine, physical work on a farm or garden is a chance to rest from creative, mental work and bring about the perspective shift that participants said was key to getting unstuck. Joshua, a contract software developer, described “mindless” gardening tasks as a counterbalance to the mental demands of his job: “The development and programming work is very mental and it can be tiring mentally, when you’re doing a lot of that [...] gardening work is a little bit better like if you’re just, you know, doing wheelbarrows of mulch, that’s nice. And you can let your mind daydream.” Gardening for him is a form of purposeful relaxation—mental rest that restores the ability to do mental work. It can also be a secondary mode of knowledge work, in which mental processing continues in the background while he is doing the physical task: “I actually find that I, you know, a lot of the ideas that I’ve had for [software projects] have happened while I’m doing that kind of work [...] it takes the focus off a little bit, but the thoughts are still there, they’re still happening.” Here we see participants pushing against the purely productivist values of grit; instead, they value rest and the belief that stepping away into something else ultimately engenders creativity and bigger payoffs. By taking a break from active programming to work on his garden—filling the gap in one kind of work with the other—he actually makes progress on both.

4.3.2 Compensating for long timelines. Another aspect of gap-filling was when participants relied on one kind of work (farming or knowledge work) to supply something that was lacking from the other kind of work. For Emily (scientific coordinator, farmer) and Rob (software developer, gardener), farm work provided a feeling of tangible accomplishment that is hard to come by in abstract, mental work. This was related to rhythms found in each kind of work—specifically, the long time scales of software or research projects versus the short time scales of some physical farm tasks.

Knowledge work tends to have long delays between the inception of a project and its completion. Because of these long timelines and the abstract nature of much knowledge work, it may be hard for a person to see the connection between their work and a positive, material outcome, especially if they are part of a large, collaborative effort. Emily said that she prefers to do routine, physical tasks for the farm instead of more creative or mentally demanding tasks (which she tends to leave to her husband and co-farmer). She drew a connection between this preference and her time in graduate school, when “I found it like really, really rewarding to empty the dishwasher because I was like, I know how long this task is gonna take, I know that I can do this task [...] it just seems like such an achievable thing for me.” She didn’t enjoy emptying the dishwasher just because it was “mindless,” but nonetheless valued this straightforward, predictable, and tangible work—an easy win, compared to the uncertainty of designing and executing research as a graduate student.

Rob appreciated garden tasks like weeding for similar reasons: because they produce immediate, tangible results. Comparing software development to working in his garden, he said that the former is abstract, in the sense that the impacts of his work are hard to measure or translate into concrete terms, and he feels distant from the material outcomes of his work: “I update lines of code that, you know, may or may not actually change anything on the screen, but they run slightly faster or it runs, you know, a little bit better or whatever [...] especially when I was managing people—now it’s, you know, I have a conversation with somebody that makes them do something a little bit better, that makes the system work a little bit better, that might impact, you know, somebody—and your timelines are a lot longer”; whereas “in the garden, I pick a weed, the weed is gone. You know, like it’s very fast feedback, it’s very tangible, you know, you can look out and see the good that you’ve done.” Routine, physical work such as can be found in farming or gardening presents a straightforward course of action and a guaranteed sense of accomplishment at the end, from material outcomes that the worker can see and touch. As Rob demonstrates with the example of weeding, such work also produces results *quickly*. It can thus fill the gaps left by the “long timelines” of abstract knowledge work—the long delay between starting a project and seeing results, and the distance between one’s work and a tangible outcome.

5 DISCUSSION

Drawing on our findings and literature, we characterize these practices—anchoring, decoupling, and gap-filling—as types of *attunement work* (Figure 1). Attunement work is a complement to the established theory of alignment work [24]; while alignment work describes how disparate rhythms are brought into workable alignment as part of collaborative work, attunement work describes how individuals configure their relationships with rhythms in order to sustain work. Thinking in terms of attunement work can help us analyze conflicts between farmers’ (particularly non-traditional farmers’) values and the values embedded in technologies. It can also guide efforts to design work-support tools that mitigate busyness and burnout.

5.1 Defining attunement work

From our analysis, we define attunement work as the ways people negotiate their relationships with various temporal rhythms, with the goal of creating sustainable work-lives. In this section,

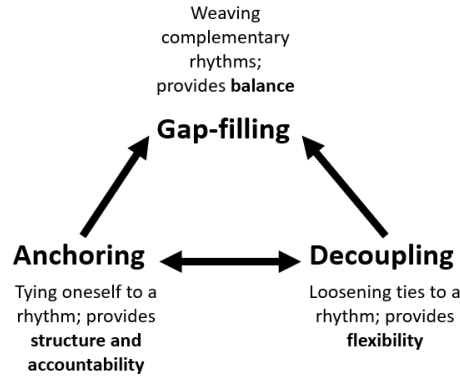


Fig. 1. Attunement work: anchoring (committing to a rhythm) and its inverse, decoupling (loosening ties to a rhythm), support gap-filling (interweaving complementary rhythms).

we invoke Science and Technology Studies (STS) and the sociology of time to further develop the concept of attunement work and situate it within these literatures.

Our findings resonate with Zerubavel’s comments on the tension between routine and spontaneity in his book *Hidden Rhythms* [65]. On the one hand, Zerubavel observes, the routinization of life (“rigidification” of the duration, sequence, and periodicity of events and activities) squashes spontaneity (freedom to do things at any time, for any length of time, in any order) and can put people out of sync with natural rhythms (p. 44-49). On the other hand, routine appeals to individuals because it relieves the burden of uncertainty and constantly needing to make decisions (p. 50-51). Routines and schedules enforce “orderliness and structure” that people otherwise struggle to maintain: “Every constraining order is at least somewhat attractive to many of us, since it provides us with the discipline that we need yet find so difficult to impose on ourselves” (p. 50). We argue that these impulses towards spontaneity and routine drive the practices of anchoring and decoupling, respectively. Anchoring to a rhythm—making it a non-negotiable part of life around which other activities must be arranged—supports structure and accountability. Decoupling from a rhythm—removing the need to attend to or synchronize with it—creates opportunities for spontaneity. Decoupling and anchoring also support the higher-order strategy of gap-filling, weaving together disparate rhythms in order to resolve tensions and create balance.

Importantly, while Zerubavel was interested in scheduling and its role in routinization, attunement work does not depend on schedules. Our participants did use scheduling tools: they mentioned, and sometimes shared with us, calendars, task boards, planners, and to-do lists. However, anchoring (for instance) is not the same as putting something on a schedule. Consider our participants who found that tending to the needs of farm animals was a good way to get regular exercise. Zerubavel asserts that “by allowing some special time for certain activities, the schedule makes sure that we get to do them” (p. 53). But this is only true in an ideal case where the person “faithfully adhere[s]” to the schedule. For many of us, putting gym time on our calendar does not ensure that we will actually go to the gym. Anchoring one’s routine to the rhythms of animals is more reliable because maintaining the routine becomes a duty of care. It involves an *affective commitment* to the animals. In this example, the fact that animals’ needs follow natural rhythms—not purely social rhythms like those Zerubavel focuses on—means that scheduling is not strictly necessary. By the same token, decoupling is not just the absence or rejection of a formal schedule; it is a choice to cut or loosen ties with a particular rhythm via some kind of workaround. Decoupling from animals’ rhythms

can be accomplished using technology, like the automated feeders and doors Anthony installed on his farm; or it can be as simple as varying one's routine so that the animals don't learn to expect food at a specific time of day, as a farmer in our previous interview study did.

We borrow the term *attunement* from STS, where it frequently has a dual meaning: sensitivity to a particular context or phenomenon; and patterns and ways of being that solidify over time. The first sense is that of being *attuned to* something, of attention and honed awareness; the second sense is that of being *attuned*, human and nonhuman actors mutually shaping and adjusting to each other to form a particular configuration [3, 11, 58]. Choy [11] expresses this dual nature via the difference between “tending” (“a sense of care and cultivation...a form of accompaniment and patience”) and “tending toward” (“a tendency to move in a direction...a property of things that emerges in relation to ambient conditions”). Our understanding of attunement also resonates with Maria Puig de la Bellacasa's [48] work on soil care in agriculture, which unites the feminist STS commitment to caring relations with an interest in temporal rhythms. She advocates a focus on “care time” as a way to make visible the multiple human and nonhuman temporalities involved in soil care, and positions humans as members of a soil community rather than outside observers exerting control over soil rhythms. Analyzing Bill Mollison's (one of the founders of the permaculture movement) concept of ‘thoughtful and protracted observation,’ she describes it as an iterative process in which soil care practitioners “learn the needs of the landscape” through deep and prolonged engagement, and the ecosystem in turn “learns” to expect and respond to human interventions. This process of mutual learning and adjustment “requires attention and fine-tuning to the temporal rhythms of an ‘other’ and to the specific relations that are being woven together”—what we would call attunement.

Attunement work, like alignment work, is a mode of relating to temporal rhythms; but it differs from alignment work in that the scope of attunement work is personal rather than organizational. Alignment work focuses on how discrepant rhythms are made to “mesh” productively so that work objectives can be accomplished. Even when alignment work has direct and intimate effects on workers' lives—as in the example of NASA teams living on Mars time to better supervise the Mars rovers, this putting them out of sync with their families who are still on Earth time [24]—the focus is on the need for rhythms to be aligned (the biographical rhythms of the team members with the phenomenal rhythm of Mars' 24.65-hour day), and the perspective is that of an outside observer. The scope does not allow for discussing the agency of individual workers and their personal relationships with particular rhythms. Attunement is also distinct from the related concept of temporal horizons, which Reddy et al. [50] introduced to describe how individuals use their knowledge of rhythms and trajectories [14, 49] to plan their work day: temporal horizons explain “how people broadly arrange their activities to ensure that they accomplish their work in a timely and appropriate manner.” Horizons can be more or less flexible (vs. inflexible) and close (vs. distant). In other words, people have an awareness of what is coming up, how soon, and how much flexibility they have in when they deal with it. Temporal horizons are similar to attunement work in being “people-based, not activity-based” [50]; however, our data were not about how people coordinate to accomplish specific work objectives, but about how they sustain the conditions that make work possible. Our participants use rhythms as resources, not primarily for the smooth and efficient accomplishment of work, but for making work sustainable.

5.2 Applying attunement work to CSCW

Having defined the conceptual framework of attunement work, we now discuss how attunement work can be applied to two threads of research in CSCW: values and technology use in agriculture, and the role of technologies in time use and busyness. In the first case, attunement work offers a way to tease out nuances within value clashes identified by existing literature. In the second

case, it supports an analysis of rhythm-based productivity tools, towards the goal of designing for slowness.

5.2.1 Farming, values, and technology. In the Related Work (Section 2), we observed that past HCI work on farming has focused on identifying farmers' values and pointing out value conflicts—friction points where the values of farmers seem incompatible with the values embedded in work support tools. This previous work has been skeptical about the merit of mainstream technologies in a small, sustainability-oriented farm context, on the grounds that the values embedded in these technologies (e.g., efficiency, control) clash with the values of farmers (e.g., sustainability, care, community). Our data, however, hint at nuance within these value conflicts. With respect to the value of efficiency, many of the farmer-knowledge workers we spoke with embraced efficiency: “Work smarter, not harder” was a phrase we heard from several participants. However, their pursuit of efficiency was uneven and strategic: they automated certain tasks while remaining committed to labor-intensive farming practices such as rotational grazing, or enjoying routine, physical chores. Attunement work provides another way to think about the role of values like efficiency in farmers' technology use. Through practices of gap-filling, anchoring, and decoupling, our participants connected to desired values (e.g. creativity, flexibility, self-care, and accomplishment) and balanced competing values (e.g. emotionally investing in work while not making it a lifestyle).

For instance, Anthony's use of automatic doors and feeders to decouple from the rhythms of his farm animals highlights nuances in the relationship between efficiency and care. Automated technologies promise more efficient use of time and labor, including less work (or less undesirable work) for farmers. For Anthony, introducing automation into his farm created more flexibility in his schedule, letting him attune his own circadian rhythms (not rising at dawn) and rhythms of his social group (being free to spend time with friends in the evening). But this decoupling does not imply a lack of care or even a desire to engage less with the animals. In fact, it supported care; while he talked about flexibility and how it is tied into his idea of “a reasonable life” for himself, his explanation also reflected concern for the animals' welfare. He wanted to know that the animals would be okay if something unexpected disrupted his routine. So automation in this case supported care in the form of resilience—the ability (for systems) to survive temporal disruption. At the same time, decoupling via labor-saving technology facilitated self-care, making Anthony's work more meaningful and sustainable.

Whereas previous work has noted how automation and data-driven farming tools reproduce Taylorism to the detriment of farmers, this example suggests that while—for example—automated technologies may foreground efficiency, that efficiency can be harnessed in meaningful ways to allow farmers to enact other values. The framework of attunement work helps us to analyze what values like “efficiency” and “care” mean to farmers and how they are accomplished, in order to better understand how these values are or are not supported by available technologies.

5.2.2 Designing for slowness. This section will illustrate the value of attunement work as a design analytic by using it to analyze the existing tool *f.lux*, which represents a class of productivity tools that promise better health and more effective work through attunement with natural rhythms. *f.lux* can be seen as supporting anchoring, but we argue that its default use is for decoupling. We then speculate about how a similar tool could be more geared toward anchoring and gap-filling, consistent with efforts to design technology for slowness [30, 44].

*f.lux*¹ is a software tool designed to help digital device users regulate their circadian rhythms. Its premise is that exposure to blue light from computer and phone screens outside of daylight hours disrupts circadian rhythms and can lead to poor sleep: “During the day, computer screens look

¹<https://justgetflux.com/>

good—they’re designed to look like the sun. But, at 9PM, 10PM, or 3AM, you probably shouldn’t be looking at the sun.” When installed on a computer or phone, f.lux automatically adjusts the device’s color settings depending on the time of day. When combined with Philips Hue smart lights, it promises to regulate the color of all lights in the house, making them “warm at night and like sunlight during the day”.

At first glance, this seems to be a tool for anchoring, tying oneself more closely to the rhythms of sunrise and sunset. It promotes a (more or less passive) awareness of this rhythm and how it interacts with one’s internal circadian rhythm. But while f.lux could indeed be used for anchoring—particularly if the user heeds the gentle warnings the software provides at night (notifications that “you are waking up in x hours” and in-app text that says “light is making your body later”)—its default use is to support decoupling. Specifically, it supports users in decoupling their circadian rhythms from sunrise and sunset.

f.lux does not intervene directly in users’ routines; it does not force you to put down your devices or turn off your lights after sunset. If anything, it is enabling people to extend their work day or simply stay up later, by reducing the negative health effects of that behavior. This is not inherently bad (there are many valid reasons to use f.lux in this way), but combined with social pressures, it has the potential to exacerbate problems associated with “busyness”—increase in the intensity of work [20], pressure to be constantly engaged in productive activity [30], lack of “down time,” and involuntary blurring of the boundaries between home and work [38]. f.lux embodies the same tension as mindfulness technologies [18] and corporate yoga classes [53] that assist overwhelmed knowledge workers to get in touch with their bodies and *recalibrate* their sense of time. As Sharma and Gregg argue, such interventions serve to make knowledge work more bearable without challenging the structural conditions in which such work takes place [18, 53].

f.lux promises to help people attune circadian rhythms for the sake of health and productivity, which fits in well with a self-optimization approach to work. But as Leshed and Sengers [30] observe, the feeling of control that productivity tools give their users is often superficial or illusory. They advocate for designs that consider “neglected but valued aspects of people’s experiences with busyness—spontaneity and dynamic interactions, downtime, and slowness”. By thinking in terms of attunement practices, we can see how f.lux or a similar tool could be “designed for slowness” instead of for efficiency [44].

A differently imagined tool could facilitate *anchoring* to natural rhythms and create *gaps* in the 9-5 work day. Such a design could take inspiration from farming, where rain makes certain kinds of outdoor work impossible, leaving the farmer or gardener to work on indoor tasks or take a break from farm work. A knowledge worker could anchor to weather with a tool that cuts off the user’s Internet access during rainstorms—thus disrupting the “artificiality” of indoor work and creating spontaneous opportunities to rest or engage in other kinds of work.

We do not propose this as a solution to busyness. Interventions and tools that target individuals will not, on their own, change the culture those individuals are part of. A tool like the one described would be impractical if the user’s supervisors, coworkers, and others do not or cannot accommodate the disruptions it produces. Rather than a practical design idea, it is a provocation to think about the value of embracing disruption and how attunement work (in this case anchoring) can be a starting point for this.

5.3 Limitations

The specific kind of attunement work that our participants do—manipulating 9–5 and natural rhythms to create sustainable work arrangements—is not equally available to all workers. For one thing, not everyone has the ability or desire to do both (largely unprofitable) farm work and computer work. The types of creative knowledge work that many of our participants are employed

in (software development, engineering) come with much higher compensation and more temporal autonomy than, for instance, a low-wage service job. Being a farmer (as opposed to a farm worker) also implies a certain level of financial resources and control over one's time. Temporal autonomy—the ability to control one's time, and to decide what rhythms to attune—is probably the most important factor that makes attunement work possible. In addition, we have focused here on the types of rhythms that are most relevant in farm work and computer-based knowledge work; other work domains may be dominated by different rhythms. Attunement work probably looks different depending on the types of work a person is blending and the level of constraints on their time.

In studying this particular group of people—relatively privileged people involved in two very different kinds of work—we are not arguing that they constitute an overlooked population that needs to be supported with better technology. Rather, we are taking theoretical inspiration from the practices of these hybrid workers. They have the economic flexibility to make different kinds of choices about how to manage their lives, which has lead them to doing this kind of attunement work—something we suspect others would do too, if they had the economic and other kinds of flexibility and stability to do so. The question is therefore, how might CSCW support other groups of workers in doing attunement work?

6 CONCLUSION

This paper extends past CSCW work on temporal rhythms by exploring the intersection of farming and computer-based knowledge work. Based on our interviews and other engagement with people at this intersection, we have identified three practices—anchoring, decoupling, and gap-filling—which together we characterize as attunement work. Attunement work is similar to the existing concept of alignment work, which refers to the invisible work of synchronizing disparate rhythms in distributed, collaborative projects. By proposing attunement work, we wish to highlight a different, more personal mode of engagement with rhythms. Rather than teams accomplishing specific work goals, attunement work is done by individuals to create sustainable work routines—temporal arrangements that support them in meeting their needs and accomplishing their values.

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REFERENCES

- [1] David Allen. 2001. *Getting Things Done: The Art of Stress-Free Productivity*. Viking, New York.
- [2] Morgan G. Ames, Janet Go, Joseph 'Jofish' Kaye, and Mirjana Spasojevic. 2011. Understanding Technology Choices and Values Through Social Class. In *Proceedings of the ACM 2011 Conference on Computer Supported Cooperative Work (CSCW '11)*. ACM, New York, NY, USA, 55–64. <https://doi.org/10.1145/1958824.1958834>
- [3] Sareeta Amrute. 2019. Of Techno-Ethics and Techno-Affects. *Feminist Review* 123, 1 (Nov. 2019), 56–73. <https://doi.org/10.1177/0141778919879744>
- [4] Blake E. Ashforth, Glen E. Kreiner, and Mel Fugate. 2000. All in a Day's Work: Boundaries and Micro Role Transitions. *The Academy of Management Review* 25, 3 (July 2000), 472–491.
- [5] James "Bo" Begole, John C. Tang, and Rosco Hill. 2003. Rhythm Modeling, Visualizations and Applications. In *Proceedings of the 16th Annual ACM Symposium on User Interface Software and Technology*. ACM, Vancouver, Canada, 11–20.
- [6] James "Bo" Begole, John C. Tang, Randall B. Smith, and Nicole Yankelovich. 2002. Work Rhythms: Analyzing Visualizations of Awareness Histories of Distributed Groups. In *Proceedings of the 2002 ACM Conference on Computer*

- Supported Cooperative Work (CSCW '02)*. Association for Computing Machinery, New York, NY, USA, 334–343. <https://doi.org/10.1145/587078.587125>
- [7] Susanne Bødker. 2016. Rethinking Technology on the Boundaries of Life and Work. *Personal and Ubiquitous Computing* 20, 4 (Aug. 2016), 533–544. <https://doi.org/10.1007/s00779-016-0933-9>
 - [8] Susanne Bødker, Henrik Korsgaard, and Joanna Saad-Sulonen. 2016. ‘A Farmer, a Place and at Least 20 Members’: The Development of Artifact Ecologies in Volunteer-based Communities. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW '16)*. ACM, New York, NY, USA, 1142–1156. <https://doi.org/10.1145/2818048.2820029>
 - [9] Alan Borning and Michael Muller. 2012. Next Steps for Value Sensitive Design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12)*. ACM, New York, NY, USA, 1125–1134. <https://doi.org/10.1145/2207676.2208560>
 - [10] Joeri Bruyninckx. 2017. Synchronicity: Time, Technicians, Instruments, and Invisible Repair. *Science, Technology, & Human Values* 42, 5 (Sept. 2017), 822–847. <https://doi.org/10.1177/0162243916689137>
 - [11] Timothy Choy. 2018. TENDING TO SUSPENSION: Abstraction and Apparatuses of Atmospheric Attunement in Matsutake Worlds. *Social Analysis* 62, 4 (2018), 54–77. <https://doi.org/10.3167/sa.2018.620404>
 - [12] Lars Rune Christensen, Hasib Ahsan, and Eshrat Akand. 2018. Krishi Kontho: An Agricultural Information Service in Bangladesh. In *Proceedings of the 10th Nordic Conference on Human-Computer Interaction (NordiCHI '18)*. Association for Computing Machinery, Oslo, Norway, 203–214. <https://doi.org/10.1145/3240167.3240225>
 - [13] Sue Campbell Clark. 2000. Work/Family Border Theory: A New Theory of Work/Family Balance. *Human Relations* 53, 6 (June 2000), 747–770. <https://doi.org/10.1177/0018726700536001>
 - [14] Juliet M. Corbin and Anselm L. Strauss. 1988. *Unending Work and Care: Managing Chronic Illness at Home* (1st ed ed.). Jossey-Bass Publishers, San Francisco.
 - [15] Janet Davis and Lisa P. Nathan. 2015. Value Sensitive Design: Applications, Adaptations, and Critiques. In *Handbook of Ethics, Values, and Technological Design: Sources, Theory, Values and Application Domains*, Jeroen van den Hoven, Pieter E. Vermaas, and Ibo van de Poel (Eds.). Springer Netherlands, Dordrecht, 11–40. https://doi.org/10.1007/978-94-007-6970-0_3
 - [16] Aparecido Fabiano Pinatti De Carvalho, Luigina Ciolfi, and Breda Gray. 2017. Detailing a Spectrum of Motivational Forces Shaping Nomadic Practices. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing*, 962–977.
 - [17] Batya Friedman. 1996. Value-Sensitive Design. *Interactions* 3, 6 (Dec. 1996), 16–23. <https://doi.org/10.1145/242485.242493>
 - [18] Melissa Gregg. 2018. *Counterproductive: Time Management in the Knowledge Economy*. Duke University Press, Durham, [North Carolina] ; London.
 - [19] Erik Grönvall, Luigina Ciolfi, Gabriela Avram, Chiara Rossitto, and Louise Barkhuus. 2016. HCI at the Boundary of Work and Life. *Personal and Ubiquitous Computing* 20, 4 (Aug. 2016), 481–485. <https://doi.org/10.1007/s00779-016-0937-5>
 - [20] David E. Guest. 2002. Perspectives on the Study of Work-life Balance. *Social Science Information* 41, 2 (June 2002), 255–279. <https://doi.org/10.1177/0539018402041002005>
 - [21] Tad Hirsch, Phoebe Sengers, Eli Blevis, Richard Beckwith, and Tapan Parikh. 2010. Making Food, Producing Sustainability. In *CHI '10 Extended Abstracts on Human Factors in Computing Systems (CHI EA '10)*. ACM, New York, NY, USA, 3147–3150. <https://doi.org/10.1145/1753846.1753939>
 - [22] Lara Houston, Steven J. Jackson, Daniela K. Rosner, Syed Ishtiaque Ahmed, Meg Young, and Laewoo Kang. 2016. Values in Repair. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 1403–1414. <https://doi.org/10.1145/2858036.2858470>
 - [23] Heide Inhetveen. 1994. Farming Women, Time and the ‘Re-agrarianization’ of Consciousness. *Time & Society* 3, 3 (Oct. 1994), 259–276. <https://doi.org/10.1177/0961463X94003003001>
 - [24] Steven Jackson, David Ribes, Ayse Buyuktur, and Geoffrey Bowker. 2011. Collaborative Rhythm : Temporal Dissonance and Alignment in Collaborative Scientific Work. In *Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW*. 245–254. <https://doi.org/10.1145/1958824.1958861>
 - [25] Nassim JafariNaimi, Lisa Nathan, and Ian Hargraves. 2015. Values as Hypotheses: Design, Inquiry, and the Service of Values. *Design Issues* 31, 4 (Oct. 2015), 91–104. https://doi.org/10.1162/DESI_a_00354
 - [26] Benjamin Koehne, Patrick C. Shih, and Judith S. Olson. 2012. Remote and Alone: Coping with Being the Remote Member on the Team. In *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work (CSCW '12)*. Association for Computing Machinery, New York, NY, USA, 1257–1266. <https://doi.org/10.1145/2145204.2145393>
 - [27] Christopher A. Le Dantec, Erika Shehan Poole, and Susan P. Wyche. 2009. Values as Lived Experience: Evolving Value Sensitive Design in Support of Value Discovery. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '09)*. Association for Computing Machinery, New York, NY, USA, 1141–1150. <https://doi.org/10.1145/1518701.1518875>

- [28] Gilly Leshed, Maria Håkansson, and Joseph 'Jofish' Kaye. 2014. "Our Life Is the Farm and Farming Is Our Life": Home-Work Coordination in Organic Farm Families. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW '14*. ACM Press, Baltimore, Maryland, USA, 487–498. <https://doi.org/10.1145/2531602.2531708>
- [29] Gilly Leshed, Masha Rosca, Michael Huang, Liza Mansbach, Yicheng Zhu, and Juan Nicolás Hernández-Aguilera. 2018. CalcuCafé: Designing for Collaboration Among Coffee Farmers to Calculate Costs of Production. *Proc. ACM Hum.-Comput. Interact.* 2, CSCW (Nov. 2018), 149:1–149:26. <https://doi.org/10.1145/3274418>
- [30] Gilly Leshed and Phoebe Sengers. 2011. "I Lie to Myself That I Have Freedom in My Own Schedule": Productivity Tools and Experiences of Busyness. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11)*. ACM, New York, NY, USA, 905–914. <https://doi.org/10.1145/1978942.1979077>
- [31] Ann Light and Daniela Petrelli. 2014. The Rhythm of Christmas: Temporality, ICT Use and Design for the Idiosyncrasies of a Major Festival. In *Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: The Future of Design (OzCHI '14)*. Association for Computing Machinery, New York, NY, USA, 159–167. <https://doi.org/10.1145/2686612.2686636>
- [32] Hajin Lim, Ian Arawjo, Yaxian Xie, Negar Khojasteh, and Susan R. Fussell. 2017. Distraction or Life Saver? The Role of Technology in Undergraduate Students' Boundary Management Strategies. *Proceedings of the ACM on Human-Computer Interaction* 1, CSCW (Dec. 2017), 68:1–68:18. <https://doi.org/10.1145/3134703>
- [33] Szu-Yu (Cyn) Liu, Shaowen Bardzell, and Jeffrey Bardzell. 2018. Out of Control: Reframing Sustainable HCI Using Permaculture. In *Proceedings of the 2018 Workshop on Computing Within Limits (LIMITS '18)*. ACM, New York, NY, USA, 2:1–2:8. <https://doi.org/10.1145/3232617.3232625>
- [34] Peter Lyle, Jaz Hee-jeong Choi, and Marcus Foth. 2015. Growing Food in the City: Design Ideations for Urban Residential Gardeners. In *Proceedings of the 7th International Conference on Communities and Technologies (C&T '15)*. ACM, New York, NY, USA, 89–97. <https://doi.org/10.1145/2768545.2768549>
- [35] Gloria Mark, Shamsi T. Iqbal, Mary Czerwinski, and Paul Johns. 2014. Bored Mondays and Focused Afternoons: The Rhythm of Attention and Online Activity in the Workplace. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*. Association for Computing Machinery, New York, NY, USA, 3025–3034. <https://doi.org/10.1145/2556288.2557204>
- [36] Gloria Mark, Stephen Volda, and Armand Cardello. 2012. "A Pace Not Dictated by Electrons": An Empirical Study of Work without Email. (2012), 10.
- [37] Melissa Mazmanian, Ingrid Erickson, and Ellie Harmon. 2015. Circumscribed Time and Porous Time: Logics as a Way of Studying Temporality. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*. Association for Computing Machinery, Vancouver, BC, Canada, 1453–1464. <https://doi.org/10.1145/2675133.2675231>
- [38] Melissa Mazmanian, Wanda J. Orlikowski, and JoAnne Yates. 2013. The Autonomy Paradox: The Implications of Mobile Email Devices for Knowledge Professionals. *Organization Science* 24, 5 (Oct. 2013), 1337–1357. <https://doi.org/10.1287/orsc.1120.0806>
- [39] Lisa P. Nathan. 2008. Ecovillages, Values, and Interactive Technology: Balancing Sustainability with Daily Life in 21st Century America. In *CHI '08 Extended Abstracts on Human Factors in Computing Systems (CHI EA '08)*. ACM, New York, NY, USA, 3723–3728. <https://doi.org/10.1145/1358628.1358920>
- [40] Magnus Nilsson and Morten Hertzum. 2005. Negotiated Rhythms of Mobile Work: Time, Place, and Work Schedules. In *Proceedings of the 2005 International ACM SIGGROUP Conference on Supporting Group Work (GROUP '05)*. Association for Computing Machinery, New York, NY, USA, 148–157. <https://doi.org/10.1145/1099203.1099233>
- [41] Christena E. Nippert-Eng. 1996. *Home and Work: Negotiating Boundaries through Everyday Life*. University of Chicago Press, Chicago, IL.
- [42] Juliet Norton, Birgit Penzenstadler, and Bill Tomlinson. 2019. Implications of Grassroots Sustainable Agriculture Community Values on the Design of Information Systems. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (Nov. 2019), 34:1–34:22. <https://doi.org/10.1145/3359136>
- [43] William Odom. 2010. "Mate, We Don't Need a Chip to Tell Us the Soil's Dry": Opportunities for Designing Interactive Systems to Support Urban Food Production. In *Proceedings of the 8th ACM Conference on Designing Interactive Systems (DIS '10)*. ACM, New York, NY, USA, 232–235. <https://doi.org/10.1145/1858171.1858211>
- [44] William Odom, Richard Banks, Abigail Durrant, David Kirk, and James Pierce. 2012. Slow Technology: Critical Reflection and Future Directions. In *Proceedings of the Designing Interactive Systems Conference (DIS '12)*. Association for Computing Machinery, New York, NY, USA, 816–817. <https://doi.org/10.1145/2317956.2318088>
- [45] Michael Quinn Patton. 2002. *Qualitative Research & Evaluation Methods*. SAGE.
- [46] Leslie A Perlow (Ed.). 1997. *Finding Time: How Corporations, Individuals, and Families Can Benefit from New Work Practices*. ILR Press, Ithaca, NY.

- [47] Katie Pine. 2012. Fragmentation and Choreography: Caring for a Patient and a Chart during Childbirth. In *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work (CSCW '12)*. Association for Computing Machinery, New York, NY, USA, 887–896. <https://doi.org/10.1145/2145204.2145336>
- [48] Maria Puig de la Bellacasa. 2015. Making Time for Soil: Technoscientific Futurity and the Pace of Care. *Social Studies of Science* 45, 5 (Oct. 2015), 691–716. <https://doi.org/10.1177/0306312715599851>
- [49] Madhu Reddy and Paul Dourish. 2002. A Finger on the Pulse: Temporal Rhythms and Information Seeking in Medical Work. In *Proceedings of the 2002 ACM Conference on Computer Supported Cooperative Work (CSCW '02)*. Association for Computing Machinery, New York, NY, USA, 344–353. <https://doi.org/10.1145/587078.587126>
- [50] Madhu Reddy, Paul Dourish, and Wanda Pratt. 2006. Temporality in Medical Work: Time Also Matters. *Computer Supported Cooperative Work: The Journal of Collaborative Computing* 15, 1 (Feb. 2006), 29–53. <https://doi.org/10.1007/s10606-005-9010-z>
- [51] Doris Ruth Eikhof. 2007. Introduction: What Work? What Life? What Balance? *Employee Relations* 29, 4 (Jan. 2007). <https://doi.org/10.1108/er.2007.01929daa.001>
- [52] Christine Salazar. 2001. Building Boundaries and Negotiating Work at Home. In *Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work (GROUP '01)*. Association for Computing Machinery, New York, NY, USA, 162–170. <https://doi.org/10.1145/500286.500311>
- [53] Sarah Sharma. 2014. *In the Meantime: Temporality and Cultural Politics*. Duke University Press, Durham.
- [54] Katie Shilton. 2018. Values and Ethics in Human-Computer Interaction. *Foundations and Trends® in Human-Computer Interaction* 12, 2 (July 2018), 107–171. <https://doi.org/10.1561/11000000073>
- [55] Stephanie B. Steinhardt and Steven J. Jackson. 2014. Reconciling Rhythms: Plans and Temporal Alignment in Collaborative Scientific Work. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW '14*. ACM Press, Baltimore, Maryland, USA, 134–145. <https://doi.org/10.1145/2531602.2531736>
- [56] Rosemary Steup, Lynn Dombrowski, and Norman Makoto Su. 2019. Feeding the World with Data: Visions of Data-Driven Farming. In *Proceedings of the 2019 on Designing Interactive Systems Conference (DIS '19)*. ACM, New York, NY, USA, 1503–1515. <https://doi.org/10.1145/3322276.3322382>
- [57] Rosemary Steup, Arvind Santhanam, Marisa Logan, Lynn Dombrowski, and Norman Makoto Su. 2018. Growing Tiny Publics: Small Farmers' Social Movement Strategies. *Proceedings of the ACM on Human-Computer Interaction* 2, CSCW (Nov. 2018), 165:1–165:24. <https://doi.org/10.1145/3274434>
- [58] Kathleen Stewart. 2011. Atmospheric Attunements. *Environment and Planning D: Society and Space* 29, 3 (June 2011), 445–453. <https://doi.org/10.1068/d9109>
- [59] Norman Makoto Su, Gloria Mark, and Sutton Stewart. 2007. Workplace Connectors as Facilitators for Work. In *Proc. of Communities and Technologies 2007*. Springer, East Lansing, MI, USA, 131–150.
- [60] E. P. Thompson. 1967. Time, Work-Discipline, and Industrial Capitalism. *Past & Present* 38 (1967), 56–97.
- [61] Phillip Vannini. 2012. *Ferry Tales: Mobility, Place, and Time on Canada's West Coast*. Routledge.
- [62] Amy Volda, Lynn Dombrowski, Gillian R. Hayes, and Melissa Mazmanian. 2014. Shared Values/Conflicting Logics: Working around e-Government Systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*. Association for Computing Machinery, New York, NY, USA, 3583–3592. <https://doi.org/10.1145/2556288.2556971>
- [63] Judy Wajcman. 2015. *Pressed for Time: The Acceleration of Life in Digital Capitalism*. The University of Chicago Press, Chicago.
- [64] Judy Wajcman. 2018. How Silicon Valley Sets Time. *New Media & Society* (Dec. 2018). <https://doi.org/10.1177/1461444818820073>
- [65] Eviatar Zerubavel. 1981. *Hidden Rhythms: Schedules and Calendars in Social Life*. University of Chicago Press, Chicago.

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