Envisioning New Productivity Tools for Domestic Information Work Environments

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The home will serve as a primary workplace for information workers for the foreseeable future due to the coronavirus pandemic. This fundamental change in the context of work suggests that HCI and CSCW researchers will need to more intentionally focus on exploring how to design productivity tools for domestic environments. While past work has examined productivity and well-being in the context of traditional offices, few studies have examined these ideas in the home. In this position paper, we propose a new way of designing productivity tools for the home in light of previous research on domestic technologies, productivity tracking tools in the office setting, and pluralistic notions of productivity. We argue that productivity tools should be designed to (1) help information workers critically reflect on their domestic and work-centric time management practices in order to build their own pluralistic perspective on productivity, and (2) to incorporate multiple temporalities.

Additional Key Words and Phrases: reflection, productivity, well-being, information worker, working from home, domestic technology, self-tracking, temporality

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1 INTRODUCTION

It is predicted that the post-COVID-19 workplace will look very different from our prior working environments. For one thing, working from home may continue to be the new normal for many. While only about 4 percent of the US workforce was working from home at least half the time pre-COVID-19, according to a recent study, more people (about 34% of Americans) are willing to and can work from home [7]. Companies have also become more comfortable hiring fully remote employees [15]. Although there are many advantages to working from home (e.g., saving commuting time), many people have reported that managing their time to maintain prior levels of productivity is a particular challenge. As the boundary between family and work lives become intertwined, people are having difficulty managing their time well to demonstrate their work performance and are experiencing higher levels of stress [10, 12].

It is known that information workers often have trouble managing their time due to highly demanding workloads and internal or/and external interruptions [18, 28]. They often feel that they use their time ineffectively, resulting in frustration, stress, and anxiety. To deal with these issues, a large body of human–computer interaction (HCI) and computer-supported cooperative work (CSCW) research has examined how to improve productivity and well-being in the context of traditional offices. However, few studies have examined how to improve productivity and well-being in home workspaces, even though the domestic environment has become one of the main research domains in HCI and CSCW for several decades. Home is a very unique and diverse space where idiosyncratic factors can influence productivity, personal wellness, and family bonding. We argue that the means

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for understanding an information worker in the office context should be reevaluated in the domestic environment, and other considerations such as emotional effect, cultural contexts, and aesthetics, should be taken into account when designing technologies for a domestic setting [3, 42].

In this position paper, we propose a new way of designing productivity tools for the home in light of previous research on domestic technologies, productivity tracking tools in the office setting, and pluralistic notions of productivity. We argue that productivity tools should be designed to (1) help information workers critically reflect on their domestic and work-centric time management practices in order to build their own pluralistic perspective on productivity, and (2) to incorporate multiple temporalities.

2 DOMESTIC TECHNOLOGIES

As information technologies became widely available in the home, HCI research turned its attention to domestic environments. In contrast with the office space, the home involves unique and diverse aspects that prompted HCI researchers to take account of not just usability but also everyday experiences in domestic lives [3, 42]. Improving family members' experiences at home has been considered a main theme for discussing technology design in domestic environments. On the one hand, much research has investigated how state-of-the-art technology can be embedded in the home (e.g., [1, 6]). Following the rapid growth of the marketplace, many 'smart' devices, such as smart speakers or smart thermostats, have become a major research topic in HCI [4, 45]. On the other hand, by focusing on family members' mundane experiences and family rituals, some researchers investigated how technology might enrich people's experiences at home [25, 41]. For instance, Sellen et al. [39] developed and deployed a domestic communication technology for the family, inspired by paper-based messaging in the home. Desjardins et al. [13] argued that domestic technologies should be designed by taking into account people's lived-in environments.

Since the home has been considered a living space rather than a working space, much research in HCI focused on people's domestic practices or the social relationships between family members and the technologies to support these kinds of practices. As mobile computing technologies have become more widely available, the home has also been viewed as a collateral workspace for information workers [12, 19, 30]. Despite the growth of this "always online" trend, office spaces are still considered to be the main place in which information workers perform their tasks. While there has been discussion of technology design to facilitate work experience [5], little attention has been paid to the design of technological tools to support productivity along with considerations of how full-time distributed workers' lived experiences at home reshape their performance.

Due to COVID-19, the definitions of the office and the workday are likely to change, and thus we argue that new technological tools to support productivity and personal wellness at home should be discussed in accordance with the characteristics of domestic environments. To explore a new way of designing productivity tools in the home setting, we present how productivity tools have been designed and developed in the office setting and how the notion of productivity influences the design of these technologies.

3 TECHNOLOGICAL TOOLS TO SUPPORT PRODUCTIVITY AND WELLNESS

Prior research has widely employed self-tracking, including sensing technologies, to improve productivity. For instance, self-monitoring tools (e.g., [11, 24, 43]) help improve the self-awareness of how people use time and manage it well by tracking time and calculating a productivity score. By capturing how people spend their time during work, these systems aimed to induce behavior changes for using time more efficiently. Some systems are designed to improve people's productivity and well-being by blocking interruptions at the workplace. These systems automatically infer information workers' interruptibility by measuring computer logs [46] or physiological states [37] and indicate

the current status of users to help other office workers to figure out if an interruption would be welcome or unwelcome [21]. Also, machine learning models can be utilized to predict the ideal moments to switch to a different task to optimize people's happiness and productivity [22].

These kinds of data-driven approaches to designing technologies have also been dominant in affective technologies. Sanches et al. found that most of these systems have primarily focused on either diagnosing affective disorders (i.e., depression, anxiety) or collecting personal data related to users' mental well-being [36]. Technologies that leverage data-driven techniques often aim to stimulate *reflection* for cultivating knowledge and catalyzing behavior change. For instance, personal informatics systems are primarily designed to capture longitudinal data and support reflection in generating insights for self-improvement and facilitating behavior change [27]. While much research has explored various strategies to stimulate reflection, most reflective practices supported by tracking systems often fail to stimulate critical reflection [9, 35], which are understood to more effectively transform self-knowledge into new behavior and the consideration of wider implications to make a conscious decision [40].

The concept of *reflection-in-action* [38] has been highly influential in HCI work to develop systems to support reflection [2]. Schön introduced the reflection-in-action concept to emphasize the improvisational character of reflective practice. He argued that "our knowing is in our action" [38, p. 49]; although we hardly provide an accurate or complete description of what we know, we make many decisions-in-action based on our tacit recognition and customary activities.

The main considerations of designing productivity tools are: (1) the convenience of data collection, (2) optimization of models for predicting more accurate outcomes, and (3) formulation of better visualizations or other forms of data presentation to provide *ready-made* insights rather than scaffold the process of reflection. This is because reflection is taken for granted in the use of tracking tools; as long as individuals are presented with data collected about their emotional or behavioral state, systems have often been presumed to enable those individuals to "gain insights" about their state and to facilitate (potential) behavior change. Design strategies grounded in this assumption might have the potential to foster reflection-in-action, if people may know something in the midst of their actions. However, it ignores one important notion in the reflection-in-action, which is that *reflection-in-action should be a process of the problem setting, not a problem solving* [38].

It appears that data-driven techniques to detect people's emotional or behavioral state more accurately and to provide more effective recommendations are viewed as an imperative tool for supporting productivity and wellness. While many ethical considerations are simultaneously discussed to reduce the risks of misuse of these technologies, the discourse of "magical" machine learning algorithms (i.e., enchanted determinism) is pervasive in technology design, and places a value on accurately assessing and diagnosing people's emotional and behavioral state over helping users to gain a deeper understanding of mundane experiences in everyday lives [8]. We suspect that the mode of enchanted determinism in designing productivity technologies may be related to why they fail to stimulate critical reflection. We argue that algorithmic considerations are not necessarily best for supporting self-reflection. Instead, we believe that reflective practice might be more effectively fostered through support for noticing aspects of lived experience and exploring other ways of seeing, in contrast to machine-assisted routinization. Given the fact that domestic environments are more complex and sometimes contradictory to design requirements common in the office workplace, we believe that the locational shift of work provides more space to critically think about how working practices at home might help people to improve their productivity and feeling of satisfaction for their mental well-being, overall.

4 THE NOTION OF PRODUCTIVITY IN OUR CULTURAL CONTEXTS AND TECHNOLOGIES

Productivity, especially in the office or organization setting, has been measured and investigated in a standardized procedure that narrowly focuses on efficiency and effectiveness. So, the output of work, such as the number of tasks completed or the quality of the result, is often considered as a barometer to evaluate productivity [34]. However, perceiving and defining productivity is diverse depending on individual differences [23, 32]. Although the tangible output of tasks is an important aspect for evaluating an individual's productivity, people's emotional states or socio-environmental factors are also highly associated with their perceived productivity. For instance, research participants felt as if they were productive when they used their spare time constructively during their commute time [23]. Also, the more these respondents enjoyed a task, the more they felt productive. These empirical findings challenge the idea of a one-size-fits-all approach to designing technological tools for supporting productivity. Without considerations of personal lived experiences and values in the design of a productivity tool, it is difficult for information workers to make effective use of the technology in their domestic environments.

Even more critical is that a restricted notion of productivity implanted in our culture and technologies can harm information workers' mental well-being. Leshed and Sengers found that even though productivity tools facilitate people's activities, they reinforce the notion that they need to always be busy [26]. As we have seen from recent papers [23, 32], the cultural norm of busyness is ingrained in how people evaluate their performance. Rather than help people to think more holistically about their work and life, technologies force them to be in a constant functional state. As a result, people often feel a loss of their productivity, leading to stress or anxiety [20, 26]. For instance, many parents are struggling with child care (e.g., home schooling) at home, and they rarely keep their routine working pattern they used to follow in office settings. Given the unique domestic circumstances, the current notion of productivity might no longer be able to promote information workers' efficiency in their tasks and to make them satisfied with their working experiences at home.

To promote a more holistic view of work and life at home, a dominant perspective of time in design technology should be discouraged. Mazmanian et al. [29] found that the dominant time logic is not sufficient to encapsulate lived temporal experience. Pschetz [33] urged that a pluralistic approach to temporality should be considered in design technology to encompass more situated and nuanced temporalities. Even though many technological tools provide accurate information about behavioral or emotional states to help manage time, these technologies appear to formalize our notion of time, work, and productivity in a single, but restricted point of view. In this perspective, time should be measured in exact quantitative and objective ways (i.e., circumscribed time [29]), and therefore busyness plays an important virtue in our work. We do not argue that performing tasks more effectively and efficiently is not important to increase productivity and mental well-being. Making a better outcome by spending less time should be pursued in the domestic environment as well. However, to better support productivity, we argue that technological tools in domestic environments should incorporate multiple temporalities from people's everyday lives rather than apply the dominant notion of time that makes people save more time and speed up their lives to be more efficient and effective.

Imagine some possible scenarios, based on currently plausible/possible technologies: [1] Suppose that we have a smart device that analyzes our behavior and notify other family members of the level of interruptibility in order to prevent any disturbance from our children. Imagine that our company asks us to install a machine learning application to record our behavior (or even to take video of

[1]Retrieved from https://www.technologyreview.com/2020/06/04/1002671/startup-ai-workers-productivity-score-bias-machine-learning-business-covid/, June 2020

our screens) in order to score our productivity and encourage us to speed up. Within the dominant temporal logic, these speculative technologies are designed to control information workers' time to manage their productivity with scant regard for their lives in domestic environments. We envision that porous temporal logic [29], an alternative way of understanding temporal experience, should be the alternative mode to design productivity tools for domestic environments.

5 DISCUSSION AND CONCLUSION

Previous studies clearly showed that we should consider a different way of engaging with productivity technologies in domestic environments. Although current technological tools may encourage office workers to be more productive from the dominant perspective of work and time, it might not only aggravate information workers' working experiences at home but also raise concerns about ethical issues. We argue that current productivity tools that are designed to be optimized for office spaces shouldn't be applied in the domestic workplace in the same manner. Rather than keep information workers busy, productivity tools at home should incorporate temporality from their everyday practices [29, 33]. Additionally, rather than providing *ready-made* insights by applying predetermined metrics of productivity, these new technologies should help information workers to critically reflect on their domestic situations and their time management practices in order to build pluralistic perspectives about both productivity and temporality.

In the domestic technology literature, there is a type of work that focuses on mundane artifacts that are situated in our everyday lives to promote reflection on our lives (e.g., [17, 31]). This type of work aims at promoting users' curiosity and making them reflect on their experiences to achieve new understandings rather than provide clear or efficient solutions [16]. We believe that there is an opportunity to develop novel domestic technologies for supporting productivity and well-being with a *material perspective* of the artifacts in the home [14, 44]. By making use of everyday artifacts that have been placed in domestic environments, productivity tools should be designed to empower information workers to manage their time for not only performance but also wellness for family life.

6 WHAT ARE YOU HOPING TO GAIN OR LEARN FROM THE SYMPOSIUM?

We hope our work will foster a discussion with other workshop participants, through which we can collectively explore future directions for designing productivity tools to support information workers' productivity and well-being as work continues to move into the home. Specifically, we are excited to discuss the potential for qualities of mundane artifacts for supporting productivity and well-being, as well as the role of critical reflection to facilitate pluralistic views of time and productivity.

We are also excited to learn from other participants who have other disciplinary or industrial backgrounds.

7 AUTHORS' BIOGRAPHICAL STATEMENTS

Janghee Cho (https://tmilab.colorado.edu/ janghee) is a Ph.D. student in Information Science at the University of Colorado Boulder. He is interested in understanding how people make sense of data and AI-driven technologies and systems to support critical reflection.
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