Exploring the Effectiveness of Time-Lapse Screen Recordings for Self-Reflection in Work Contexts

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ABSTRACT

Effective self-tracking in working contexts empowers individuals to explore and reflect on past activities. Recordings of computer activities contain rich metadata that can offer valuable insight into users' previous tasks and endeavors. However, presenting a simple summary of time usage may not effectively engage users with data because it is not contextualized, and users may not understand what to do with the data. This work explores time-lapse videos as a visual-temporal medium to facilitate self-reflection among workers in productivity contexts. To explore this space, we conducted a four-week study (n = 15) to investigate how a computer screen's history of states can help workers recall previous undertakings and gain comprehensive insights via self-reflection. Our results support that watching time-lapse videos can enhance self-reflection more effectively than traditional self-tracking tools by providing contextual clues about users' past activities. The experience with both traditional tools and time-lapse videos resulted in increased productivity. Additionally, time-lapse videos assist users in cultivating a positive understanding of their work. We discuss how multimodal cues, such as time-lapse videos, can complement personal informatics tools.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **HCI theory, concepts and models**; **User studies**; **Empirical studies in HCI**.

KEYWORDS

Self-tracking, Self-reflection, Visual History, Behavior Change

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1 INTRODUCTION

Due to the emerging prevalence of self-tracking technology, the use of applications, devices, and services to systematically and efficiently collect data to achieve various goals is becoming increasingly common [27, 37, 40, 43]. Those who use self-tracking tools are interested in gaining self-awareness by tracking their activities and investigating the resulting data [8, 10, 39, 41, 47, 53, 66]. Following the data collection phase, self-trackers can explore the recorded information to understand their past activities, behaviors, and themselves profoundly—a process termed *self-reflection* [7, 26, 47].

Effective utilization of personal informatics may significantly benefit modern knowledge workers seeking to understand their productivity and induce desirable behavioral changes. Because computer users are confronted with diverse computing tasks and frequently switch contexts during multitasking [17, 20], recording daily computer activities through self-tracking has gradually gained acceptance in productivity contexts [32, 40, 44, 56, 76]. Existing research suggests that tracking time usage in the context of work can facilitate further reflection and behavioral change among users. However, while data can facilitate self-reflection on time usage, simple summaries of time usage may not be enough to effectively engage users with personal informatics and lead to actual productivity gain; furthermore, users may struggle to make sense of such summaries. In the words of a participant from another study, "What is the meaning of the statistics? I just see yet another pie chart [56]." Besides, some types of data are prone to miscategorization, resulting in misleading productivity summaries [12]. For example, tracking applications (e.g., RescueTime) might wrongly categorize time spent watching programming tutorials on YouTube as "very distracting". In this, we see an emerging need to incorporate meaningful contextual information into personal informatics applications.

To address this need, we explored time-lapse videos of a computer screen to enhance an existing personal informatics system for facilitating self-reflection. This approach was suggested in Fleck and Fitzpatrick's framework, which states that audiovisual recordings can facilitate a higher level of reflection thanks to the contextual information preserved within them [25, 26]. Time-lapse videos, which are generated from pictures taken at regular intervals, are effective for presenting processes that occur over long periods of time [61]. Compared to ordinary videos (e.g., real-time recordings with audio), the advantages of time-lapse videos include reduced storage requirements, condensed viewing, privacy preservation with no audio, and unique storytelling [72, 78]. Individuals can more readily perceive the passage of time from time-lapse videos and easily obtain an overview of past activities in minutes. Time-lapse videos have been used widely in various contexts: to help understand human and animal behavior [29, 60], build physical models [52], study geographical environments [54], and facilitate "life-logging" [66]. In a productivity context, researchers have studied screenshots and screenshot histories as means of storing rich visual details about

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a task or work environment [32, 33, 62]. In view of this, we pose the question of how a computer's screenshot history presented in a time-lapse video format can facilitate self-reflection differently from conventional personal informatics solutions.

To answer this question, we will examine the effectiveness of time-lapse video recordings of computer activities for knowledge workers by assessing the recordings' perceived value after practical usage. This research project aims to address the following research questions:

- (RQ 1) To what extent does watching time-lapse videos of past computing activities affect workers' productivity and the videos' perceived values for self-reflection?
- (RQ 2) How does watching time-lapse videos of past computing activities facilitate the self-reflection process for modern knowledge workers?

To answer these questions, we conducted a four-week field study in which we asked knowledge workers (n = 15) to use both a traditional productivity tool, RescueTime, and time-lapse videos of their computer screens for ten working days under each condition. For RQ1, we employed a quantitative approach and recorded participants' productivity scores from RescueTime. Additionally, we inquired about their daily perceived productivity and the effectiveness of the tools they used. For RQ2, we conducted a diary study and exit interviews to gain qualitative insights into how the time-lapse videos helped participants reflect on their work and productivity. We discovered that using time-lapse videos increased their perceived productivity, and participants found these videos more helpful than the RescueTime summary. Although the use of time-lapse videos did not result in a measurable productivity gain, we found strong evidence supporting the effectiveness of using both types of applications in enhancing productivity. In other words, a consistent learning effect emerged, showing that exposure to both applications led to a productivity gain. These results indicate that, with rich visual information, utilizing time-lapse videos as a self-reflection method can facilitate knowledge workers' understanding of their past computing activities, encourage beneficial behavior change, and improve well-being facets.We discuss the outcomes of using time-lapse videos as a way to foster the process of self-reflection and improve working productivity.

2 RELATED WORK

2.1 Personal Informatics and Productivity

Personal informatics (PI) refers to tools and methods aimed at assisting users in collecting personal data for self-tracking and self-reflection [24, 47, 48]. The idea of harnessing personal data using various tools and technologies to monitor and record individuals' activities has gained significant attention, with a tendency toward replacing manual logging with automated methods [10]. Among various domains, health informatics has driven the development of PI. Users gain the ability to perceive and recognize various behaviors and states relevant to health and wellness: caloric intake and consumption [21], sleep quality [9], heart rate and blood pressure [28, 30], fertility [15], diabetes management [51], mental well-being [38], sedentary behaviors [14, 31], taking a break from work [50], and so on. This repository of information empowers users to undertake self-evaluation, motivates adjustments, and encourages users to change their behaviors.

The increasing pervasiveness of computers, wearable devices, and various hardware has significantly contributed to the revolution in self-tracking to fulfill individual goals [10]. In tandem with these devices and technologies, PI was developed to illustrate users' cyclical behaviors, focusing on methodologies that can facilitate the systematic collection, integration, and use of personally relevant information [39, 74]. A simple visualization of personal data can provide insight into a user's behaviors [8]. Based on PI models, users' activities can be divided into five distinct stages: preparation, collection, integration, reflection, and action, along with the iterative processes of pausing and resuming [24, 47].

As for digital interactions, researchers have explored the benefits of knowledge workers monitoring how much time they spend across various computer activities to maintain high work focus [40, 56, 73]. An awareness of time usage may help users reduce time wasted on noncritical activities by reviewing recorded past results and leveraging outcomes as insightful findings to interpret. For instance, Kim et al. explored the effects of positive and negative framing of personal data on enhancing working productivity [40]. In this paper, we extend the literature by developing an understanding of how to provide contextual information that can enhance productivity by studying time-lapse videos of computer screens.

2.2 Facilitating Self-Reflection

PI researchers have invested effort in creating and utilizing systems not only to gather personal data, but also to facilitate desired changes effectively in their daily lives. In this context, the stage of reflection occupies a pivotal space in interpreting tracked data [8, 47]. Self-reflection is a crucial step for turning the insights gained from data into behavioral or perceptual changes. Empirical investigations conducted earlier demonstrated that an appropriate self-reflecting process could be adopted to help users become more aware of their behaviors [6], make better decisions [22], and change their habits in multiple domains [8, 19]. These reflection and action behaviors may be more effective with a data-driven approach, as opposed to relying on intuition or prior personal experience.

Reflection can be supported by various PI features. Fleck and Fitzpatrick explored the design space for five different levels of reflection, from simply revisiting data to transformative and critical reflection [26]. This framework suggests that *multimodal recording* can facilitate dialogic reflection [25, 26, 65]. In a productivity context, summarizing time usage does not effectively engage users with data because the data is not contextualized with their goals and workload; users may be "simply not sure what to do with this information" [12]. Cho et al. analyzed existing PI applications and found that there is limited space for workers to engage with data beyond simply displaying a summary of collected data [7]. Our work aims to address this limitation by offering a means to engage with PI through multimodal recordings, providing users with deeper insights into their data in the context of productivity.

2.3 Context Recovery at Work and Visual Cues for Retrospection

Given the ubiquity of digital resources and the complexity of computing tasks, mental context recovery has often been studied in the context of interruptions and subsequent task resumption [4, 34, 42]. For example, Brumby et al. identified a trade-off between time and recall accuracy [4]. Iqbal and Horvitz found that workers rely heavily on visual cues to resume their tasks; application windows with icons also represent a particular type of visual cue that assists computer users in discerning which (sub)tasks require continuation and completion when they resume tasks after interruptions or breaks [34, 42]. Similar results have been found in the context of software engineers resuming interrupted programming tasks [57, 58]. The literature indicates that visual cues are crucial in mental context recovery, and this may be an essential prerequisite for self-reflection.

Researchers have harnessed the potential of images and visual cues that contain past activities to trigger episodic memory. Lamming et al. found that combining visual cues and related materials with conventional tools could aid individuals in restoring faded mental contexts and recalling past activities, thereby reaping the benefits of autobiographical memory [45, 46]. The researchers posited that participants could produce more comprehensive recollections of their daily lives when reviewing films of past activities, compared to relying solely on contextual summaries or individual memory.

Leveraging the benefits of visual cues in context recovery, computer screenshot images have proven to be an effective medium for this purpose. Czerwinski and Horvitz noticed that recorded footage of workers' computer usage can serve as an effective cue, enabling users to recall prior computing events, including searching, editing, and coding, even after several months [16]. Recently, researchers have conducted diary studies on how screenshots are utilized in performing computing tasks on mobile phones [36]. Another illustrative example is WindowScape, which empowers users to capture a group of windows within a screenshot, enabling a swift transition between digital workspaces in seconds [70]. Another work used screenshots as "bookmarks"—essentially, visual handles to curate resources—effectively capturing multiple applications that are relevant to a task and reopening them from the image [33].

Although these studies have demonstrated that users can benefit from recognizing their prior activities through images and other visual information, a noteworthy gap persists regarding whether people can advance beyond recalling their cognitive processes at the time in detail and reflect on their collected personal visual cues. Self-reflection and retrospection could be essential in influencing knowledge workers' future behaviors, particularly concerning their productivity. In view of this, it becomes imperative to investigate how visual cues and historical data can assist knowledge workers in the process of reflecting and deriving insights.

2.4 Time-Lapse Videos in Practice

Time-lapse photography is a technique in which a camera captures a series of discrete frames at predetermined intervals over an extended period. The resulting time-lapse video displays a process that unfolded over an extended duration in compressed time, given that the capture interval is much lower than the typical frame capture rate of a conventional video recording. When a series of images is played back at accelerated speeds, it creates the deceptive perception that time is passing quickly or events are occurring rapidly—hence the term "lapse" [2]. Taking advantage of both the time and storage savings and the format's suitability for storytelling, time-lapse photographic technology is widely applied to various topics and products to depict an overview of past activities [72, 78]. Additionally, time-lapse videos are already a commonly used and efficient surveillance tool for observing perpetual behaviors and animal activities. This methodology is particularly evident in applications such as observing bird nesting [60], investigating dairy cattle behavior [55], detecting animals in the wild [68], and documenting and monitoring the performance and progress of construction projects [1, 77].

The human visual system is powerful enough to recognize rich details in images and spot image differences. Brady et al. observed that people could accurately recognize images they had seen previously 87% of the time, even when the sole difference among the displayed images pertained to the locations or poses of objects [3]. Another study reported that humans can correctly identify images containing their past activities with over 80% accuracy [66]. Retrospective recall—that is, reviewing video recordings—is often used in HCI methodology to leverage a human's recall capability on visual cues recordings [63, 64]. Utilizing time-lapse video leverages the human capability to perceive, comprehend, and recall visual information, even when presented with many images in a matter of seconds [59]. Time-lapse videos have been utilized in productivity contexts as well. For instance, ScreenTrack generates time-lapse videos by capturing screenshots at fixed intervals to aid in task resumption and mental context restoration [32]. Here, we harness the effectiveness of time-lapse videos, which has been verified through user studies and field deployments, demonstrating its capacity to augment the working productivity of computer-oriented tasks with the provision of detailed visual insights [62, 66].

3 METHODS

To corroborate the ecological validity of time-lapse videos depicting past computer activities, we conducted a four-week long field study with knowledge workers within their working contexts and environments.

3.1 Study Instrument: Time-Lapse Video Generator

For this study, we developed an application that can generate time-lapse videos with screenshots and facilitate self-reflection in a working context. Designed to capture users' computing activities, the application takes whole-screen screenshots at user-configurable intervals, and users can start or stop time-lapse video recording at any time. The menu extra, which exposes a drop-down menu and indicates the application's recording state, is shown in Figures 1 and 2. In consideration of privacy concerns raised in previous studies [32], both screenshots and videos are saved to users' local storage (e.g., Users/[user name]/Documents/time-lapse video) as opposed to storing them on an online cloud server. To alleviate the storage demands of saving a series of time-lapse videos, the application automatically deletes screenshots after using them to produce a new

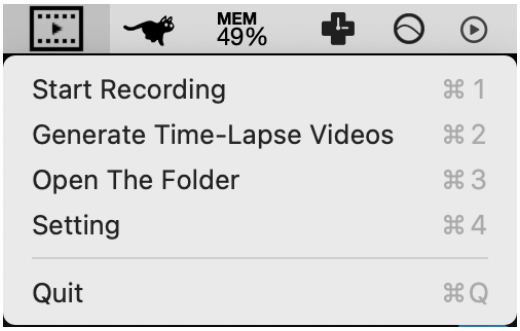

Figure 1: The application's menu extra with the drop-down menu exposed, offering the user access to key features. Users can set the video frame rate and screenshot capture interval in Setting.

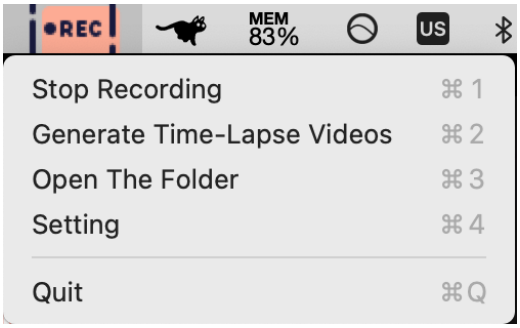

Figure 2: When recording is stopped, the menu extra has the film strip icon shown in Figure 1. The icon changes to the recording icon shown above when recording is active.

time-lapse video. To meet the demand for a user-friendly viewing experience, a single video is generated from an entire day's screenshots to eliminate the possibility of multiple time-lapse videos per day. This daily system offers a comprehensive representation of a worker's computer activities. To meet users' varied needs in terms of recognizing a working context from watching a time-lapse video, we allowed users to customize the frame rate of the generated videos (from 5 to 20 frames per second; 9 FPS by default) and the interval between screenshots, which defaults to one screenshot every 10 seconds. Consequently, if a worker records their screen for 8 hours, the resulting video will run slightly over 5 minutes (8 hours × 60 min/hour × 60 sec/min ÷ 10 second/screenshot ÷ 9 FPS = 320 seconds). When a worker's computer enters sleep mode or locks its screen (e.g., due to inactivity), the program will pause recording and resume when the computer wakes up.

3.2 Field Deployment Study

In pursuit of our research objectives and ecologically valid insights, we conducted a field deployment study with a within-subjects design to assess the effects of utilizing time-lapse videos as an approach for self-reflection, compared to an existing personal informatics tool for productivity. The study was reviewed and approved by the Internal Review Board of the authors' university.

3.2.1 Participants. The field study targeted knowledge workers, defined as those whose main capital is knowledge and whose jobs are to think for a living, including but not limited to engineers, programmers, editors, and academics [18]. We limited our participants to those knowledge workers who spend substantial time on their computers at work. We advertised the study across multiple channels, including the authors' university mailing lists, the Prolific platform, and the r/Productivity community on Reddit. Within these participant pools, we recruited 15 people who met our predefined inclusion criteria: (1) be 18 years or older, (2) use a computer that runs macOS, (3) work as a knowledge worker, (4) spend at least six working hours per day using a computer, (5) be able to install and run external applications on your work computer to record screen activities with permission from the computer's owner, (6) be the sole user of the work computer, and (7) do not perform work involving sensitive, private information (e.g., student records, information protected by regulations or an employer). Each qualified person who completed the whole user study was compensated with a $60 gift card in appreciation for their time and effort. Participants were also reimbursed for one month of a RescueTime premium plan.

3.2.2 Procedure and Data Collection. We organized the study procedure into three main phases: an initial session, a field study, and a post-study interview session. Figure 3 presents the phases of the study.

[Initial Session] At the beginning of the study, we held in-person meetings and online Zoom sessions to assist participants in preparing study requests. Participants were asked to create their own RescueTime accounts for logging their daily computer activities. Next, we instructed participants to install and set up both RescueTime and our time-lapse video application on their main working computers with agreements for producing and collecting daily computer activity data. During the initial session, all participants were asked to fill out a pre-study survey requesting demographic and background information, such as name, age, gender, and working hours. To avoid potentially biasing participants, we stated that the study's goal was to investigate how watching time-lapse videos facilitates self-reflection, as opposed to stating that the goal is to evaluate a particular system we developed. For a similar reason, we did not specifically name the study instrument installed on their computers.

[Field Study] After the initial session, we conducted a field deployment study using a within-subjects design to evaluate the effects of watching time-lapse videos as a method for self-reflection. The study lasted four weeks in all, including two conditions: (1) the Baseline (RescueTime) condition, and (2) the Treatment (Time-Lapse Video) condition. The order of the two conditions was randomized per participant (Baseline + Treatment or Treatment + Baseline).

During the Baseline (RescueTime) condition, we required participants to work on their computers with RescueTime running in the background. Participants were asked to check the RescueTime dashboard at least once per day and answer daily survey questions related to RescueTime. In the Treatment (time-lapse video) condition, participants were instructed to run our time-lapse video application to capture screenshots of their computer screens. They were also asked to watch the generated daily time-lapse videos at

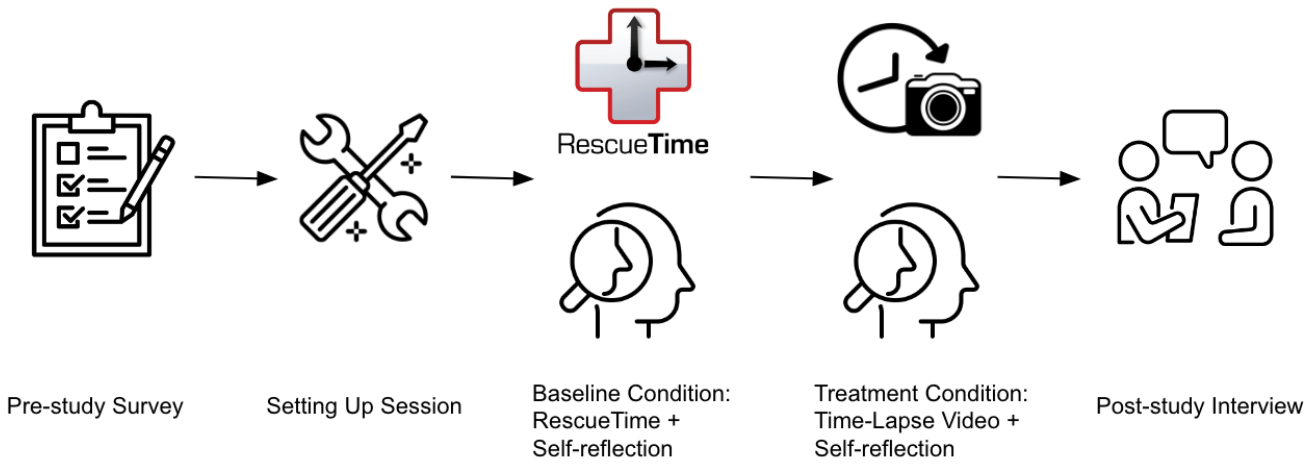

Figure 3: The full procedure of the user study, comprising an initial session, field study, and post-study interview. Note that the order of the two conditions was randomized.

least once per day. While participants were also asked to turn on RescueTime to measure their productivity pulse (see the following paragraph), they were not allowed to review the RescueTime summary in the Treatment condition. Participants completed a daily survey related to our time-lapse video application while in the Treatment condition, similar to the Baseline condition. Users were allowed to complete the daily surveys at times of their choosing. Participants could finish this daily task at the end of their ordinary habits and schedules, or they could start the day by reviewing their previous work and completing the survey. Each condition lasted two weeks (10 working days), and users were able to use their computers to handle their tasks normally. For privacy reasons, no captured screenshots, time-lapse videos, or RescueTime reports were collected from participants.

[Productivity Pulse] After the four-week user study, we collected *Productivity Pulse* data points from all participants' daily dashboards on RescueTime. RescueTime classifies each activity and application into various groups by productivity level. Productivity Pulse is a benchmark score for a user's past productivity level ranging from 0 to 100 depending on how much they used applications that are categorized as productive, neutral, or distracted[1]. We used these values to represent participants' productivity. While miscategorization is possible, the Productivity Pulse is a reasonable proxy for how a user's time counts towards work vs. non-work activities based on application types or websites.

[Daily Survey during the Field Study] Within the study period, we distributed two versions of the daily survey (one for each condition). The daily questionnaire had two 7-point Likert items (1 = Strongly Disagree, 2 = Moderately Disagree, 3 = Slightly Disagree, 4 = Neutral, 5 = Slightly Agree, 6 = Moderately Agree, 7 = Strongly Agree) designed to measure participants' *perceived productivity* ("I was productive on the day when time-lapse videos/RescueTime were recorded") and the *perceived effectiveness* of the software they used ("It was helpful to use time-lapse videos/RescueTime to understand my productivity on the day"). The daily survey also included open-ended questions that encouraged participants to reflect upon the information they received from either RescueTime or the time-lapse videos. Again, to avoid potentially biasing the participants in favor of the time-lapse videos, we purposely designed the survey and interview questions symmetrically for both the RescueTime and time-lapse video conditions. The survey questions are listed in full in Appendix A. We found that none of our metrics—Productivity Pulse, Perceived Effectiveness, and Perceived Productivity—were normally distributed. Therefore, we applied the nonparametric aligned rank transform (ART) procedure [75] and analyzed the data using repeated-measures ANOVAs.

[Post-study Interview] After the four-week field study, we conducted a semi-structured interview with each participant. In the post-study interviews, we used open-ended questions to gather qualitative feedback on task routines, usage experiences (e.g., "What is your general experience of self-tracking tools?"), self-reflection (e.g., "Was there anything surprising to you from the time-lapse videos?"), behavior changes (e.g., "What did you learn from watching the time-lapse video?"), productivity perceptions, and ways to improve the current time-lapse video system. The first author transcribed the interview recordings to familiarize themselves with the data, performed a thematic analysis [11], and initially generated 171 codes. The authors conducted axial coding by revising, merging, and deleting the initial codes, and identifying emerging themes. A full list of interview questions is available in Appendix B.

[1]RescueTime's Productivity Calculation Equation is introduced here in detail. https://help.rescuetime.com/article/73-how-is-my-productivity-pulse-calculated

3.3 Demographic Information

Of the 15 participants, 7 were female and 8 were male. Their ages ranged from 20 to 34 (mean = 27.47; std. dev. = 3.60). Twelve participants were full-time graduate students; one was a data analyst, one was a medical doctor, and one was a freelancer[2]. Participants used their computers for primary working goals for 7.07 hours per day on average (std. dev. = 2.19). They spent an average of 3.04 hours per day using their computers for other purposes (std. dev. = 2.10). As reported in the pre-study survey, 11 participants were already familiar with self-tracking and had prior experience in tracking personal data, including physical activities, sleep quality, food, and financial information. Additionally, 12 participants had prior experience watching time-lapse videos featuring primarily scenic content, such as sunsets and the Milky Way. However, none of the participants were familiar with tracking their digital activities on computers and watching recorded videos of their past computing tasks.

4 RESULTS

We present our results by reporting participants' activities and feedback regarding interactions with the tools in the study. Section 4.1 presents quantitative results that show the effectiveness of time-lapse videos in comparison to an existing productivity tool in response to RQ1, while Section 4.2 demonstrates the perceived value of time-lapse video on facilitating self-reflection as reported by our participants.

4.1 RQ1: Effects on Productivity

An overview of the quantitative data we collected is presented in Table 1. Descriptive statistics and ANOVA results for Productivity Pulse, Perceived Productivity, and Effectiveness are listed in Table 2.

4.1.1 ***Productivity Pulse.*** We conducted a repeated-measures ANOVA to test the significance of the condition (RescueTime vs. Time-Lapse Video) and time period (whether the data was collected in the first two weeks or the second two weeks) to establish whether there was a learning effect. The effect of the condition was not significant at $\alpha = 0.05$. However, we did observe a learning effect; the average Productivity Pulse in the second two weeks was greater than in the first two weeks, regardless of the condition—that is, regardless of the software used ($F(1, 297) = 5.05, p < .05$).

We further analyzed whether the order of conditions significantly impacted the results by including order (RescueTime-first or time-lapse-first) as a factor. We found that there was a significant interaction effect between condition and order ($F(1, 295) = 4.36, p < .05$). The productivity gain between the two conditions was greater for the RT-first group than for the TL-first group. This result indicates that using time-lapse videos after using RescueTime resulted in greater productivity gains than did the other ordering. Figure 4-(3,1) illustrates this result. In the graph, the order of conditions for each group is visualized as a dashed arrow. The RT-first group had a greater productivity gain than the TL-first group; the length of the right arrow (the RT-first group) is greater than that of the left arrow (the TL-first group). The implications of the ordering effect are discussed in Section 5.2, and the result of Productivity Pulse is depicted in Figure 4-(Column 1).

4.1.2 ***Perceived Productivity.*** We ran a repeated-measures ANOVA on the perceived productivity responses collected from the daily survey. The condition (RescueTime vs. time-lapse video) had a significant effect ($F(1, 286) = 6.65, p < 0.05$). We also found a significant learning effect ($F(1, 286) = 8.78, p < 0.01$).

We also found an ordering effect again; depending on the starting condition, perceived productivity increased for the RT-first group over time, whereas the TL-first group felt less productive in the second two weeks. The interaction effect between condition and order was significant ($F(1, 285) = 7.09, p < 0.01$). This result indicates that the learning effect can be attributed to the RT-first group, which reported feeling more productive when using time-lapse videos after experiencing RescueTime. This result is illustrated in Figure 4-(Column 2).

4.1.3 ***Perceived Effectiveness.*** We ran a repeated-measures ANOVA on the perceived effectiveness ratings collected from the daily survey. The condition (RescueTime vs. time-lapse video) had a significant effect ($F(1, 286) = 67.03, p < 0.001$), and there was a learning effect as well ($F(1, 286) = 51.14, p < 0.001$). This result suggests that the use of time-lapse videos significantly affected how participants understood their behaviors. The ordering effect was consistent; the interaction effect between condition and order was significant ($F(1, 285) = 24.75, p < 0.001$). The extent to which the RT-first group felt that time-lapse videos were more useful than RescueTime was much greater than in the TL-first group. This result is depicted in Figure 4-(Column 3).

4.2 RQ2: Time-Lapse Videos—Not Data—Tell Viewers a Story

From the exit interviews, we gained qualitative insights into how time-lapse videos supported the participants' review of their work and self-reflection.

4.2.1 ***Capturing More Details about Their Work.*** In general, we found that RescueTime and time-lapse videos were able to provide users with a comprehensive understanding of their daily activities and time usage. All participants (15/15) explicitly noted that time-lapse videos contained exhaustive information. They found that time-lapse videos were informative, presenting rich details about their past chronological computer engagements in minutes. Participants discerned that watching time-lapse videos was effective in recognizing and recalling the subjects of their computing tasks, along with multiple applications and contextual materials.

> *[P8] "I had several interviews in last week. I'm watching the video. The video can tell me what did... And sometimes I just don't know what I did. It [time-lapse videos] can record me what I did in detail."*

[2]One practical difficulty in recruiting a broad variety of knowledge workers was that the software we developed typically could not be installed on company-owned computers due to software liability policies in organizations. For example, our software cannot be installed on the authors' university-owned computers, as it needs to be reviewed by the IT procurement department and requires legal terms and conditions, which are beyond the scope of our research. In this regard, we had to include additional eligibility criteria (e.g., people who work from their own computers or are permitted to install our software on their employers' computers). Naturally, this yielded a limited range of participants, with the majority being graduate students. We discuss this limitation further in Section 6.

Table 1: Categories, dimensions, and descriptions of quantitative data collected during the study.

Categories	Range	Descriptions
Productivity Pulse	0–100 score	A benchmark score measured by RescueTime indicating overall productivity.
Perceived Productivity	7-point Likert items	A self-evaluated rating of a participant's personal productivity for each day.
Perceived Effectiveness	7-point Likert items	A self-assessed rating of perceived effectiveness of the intervention used.

Table 2: Quantitative results: RescueTime vs. time-lapse videos and ordering effects. Note: $p < .05^{*}, p < .01^{**}, p < .001^{***}$

Measures	RescueTime		Time-lapse video		F-value	First two weeks		Second two weeks		F-value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Productivity Pulse	62.6	18.1	64.8	17.9	$F(1, 297) = 1.58$	61.3	16.8	66.0	18.9	$F(1, 297) = 5.05^{*}$
Perceived Productivity	4.7	1.8	5.2	1.6	$F(1, 286) = 6.65^{*}$	4.8	1.6	5.2	1.8	$F(1, 286) = 8.78^{**}$
Perceived Effectiveness	5.1	1.8	6.0	1.2	$F(1, 286) = 67.03^{***}$	5.2	1.7	5.9	1.4	$F(1, 286) = 51.14^{***}$

> *[P11] "I really like about the time-lapse video is like storytelling. So like a quick story, all the hours of your entire day are reflected back in just a couple of minutes."*
>
> *[P12] "It [time-lapse videos] gives me an idea about how I spend my time on my computer while when I'm personally using my computer. I easily lose track of time when I was like, uh, doing some sort of relaxing thing. So generally speaking, this tracking activity can provide me with more details about my past activities."*

As one type of visual history, time-lapse videos were proven to assist individuals in quickly recalling what they were doing precisely for self-awareness and improving the following self-reflection.

4.2.2 ***Effective for Task-Oriented Reflection.*** In the context of complicated, knowledge-based tasks, users typically need to switch resources among multiple applications frequently or divide their attention to multitasking. RescueTime, in which users' past activities were mainly classified according to applications, websites, and platforms, makes it challenging for people to develop exhaustive awareness of how they completed a given task. During self-reflection, participants (13/15) looked for more task-based traces that could thoroughly explain their previous activities. Unlike tracking the usage of each application independently in RescueTime, the whole procedure of working on a task can be recorded as a cohesively integrated process in time-lapse videos.

> *[P10] "I mean, if there's a lot of different types of activities and a lot of activity switches, I feel time-lapse video provided a lot really a rich information for me ... when I did a lot of multitasking, the time-lapse video is actually very helpful."*
>
> *[p14] "RescueTime is kind of different. It tracks my time, but it does not track the goal. This task-oriented method [time-lapse video] is more suitable for me because it is more clear to me how much work I've done instead of how much time I've spent."*

These participants' comments shed light on the effectiveness of time-lapse videos for offering users a comprehensive understanding of their past actions for task-oriented goals.

4.2.3 ***Preserved Step-by-Step Progress and Visual Reminders.*** To create time-lapse videos, our application takes screenshots at regular, user-configurable intervals to capture what is happening on a user's screen in real time. Participants perceived the benefit of identifying how they complete their computing tasks; that is, being able to acknowledge their efforts, progress, and outcomes one step at a time. In our exit interviews, 10 out of 15 participants mentioned that time-lapse videos served as a tool that provided them with supplementary visual cues on how they finish their tasks stage by stage and showed the flow of their work.

> *[P2] "So I had a time-lapse video during the time when I was analyzing and writing my codebook. It helped me see how each line or each step was contributing to the overall picture. And it was really cool to see how the codebook got longer and longer throughout time. And in that way, it was motivating."*
>
> *[P3] "For example, when I edit the financial report, I may add some logic, revise it and change it for multiple versions. Sometimes it is hard to remember what I did in the first version in the morning. Some issues need to be fixed later on, and I cannot recall what I've done in the prior version. So time-lapse Video is able to help capture that kind of detail from my screen."*

In addition, it is clear from the participants' comments that time-lapse videos effectively reminded users of how they progressed to the current phase of a project. Some trivial actions and unfinished tasks could be captured by screenshots and presented to users later. Of our 15 participants, 9 stated that the time-lapse videos contributed to a visualized reminder with insightful clues that could help them recall each of their activities.

> *[P15] "I wanted to get a result from the experiments, but the expected result was not found at that time. I got demotivated and I started watching some videos or going on social media. Later when I was watching the time-lapse videos, I was surprised that I forgot this work. So I got back to work and solved the issue."*
>
> *[P10] "It [time-lapse video] provides me a better visualization of what I did in the past day. So in that case, I really prefer time-lapse video because if I'm going to reflect [on] what I did for the whole day, sometimes I couldn't recall [all my tasks]."*

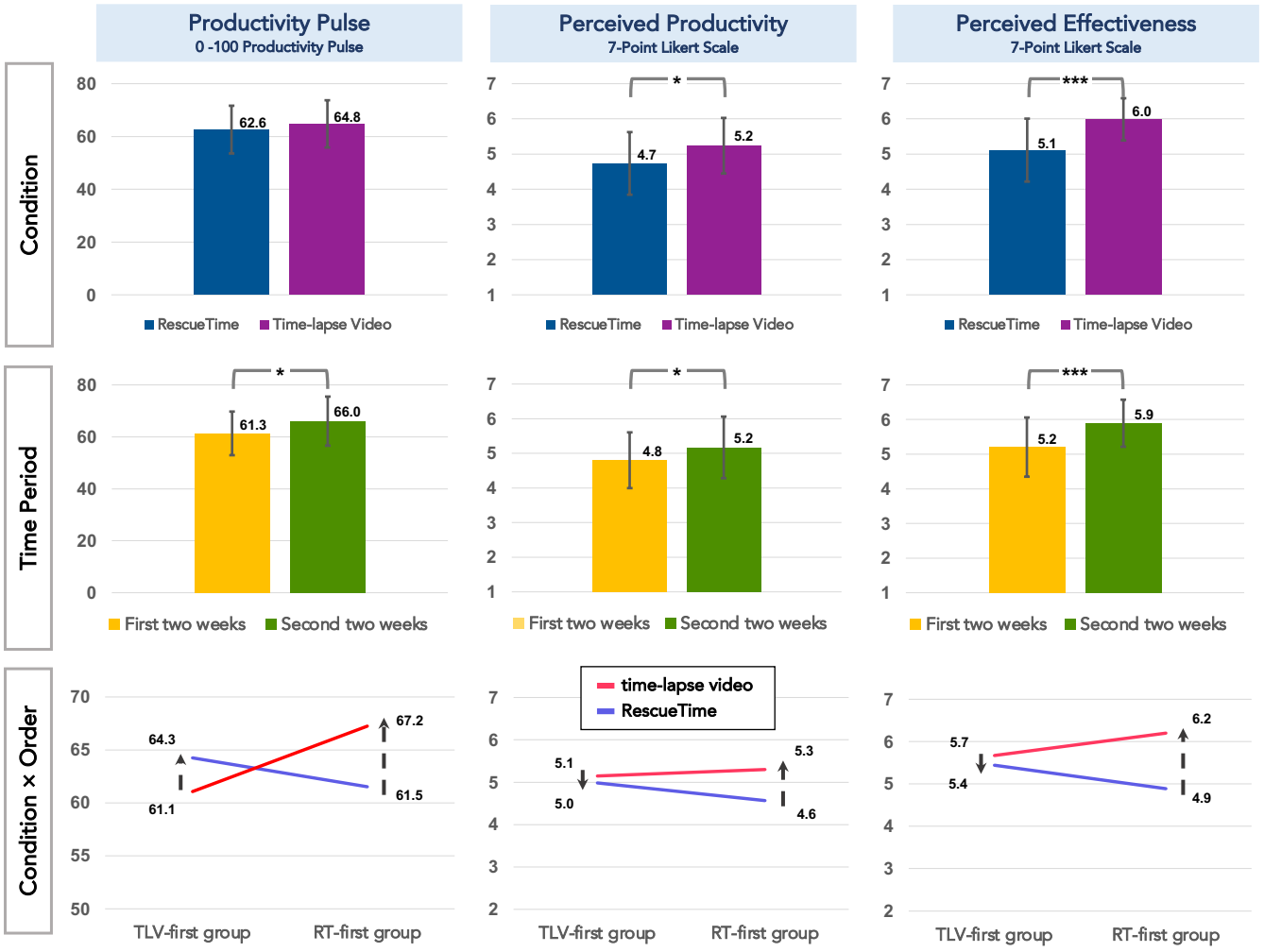

Figure 4: Quantitative results. The columns show results for Productivity Pulse (Column 1), Perceived Productivity (Column 2), and Perceived Effectiveness (Column 3) across different factors. Row 1: Metrics analyzed by condition (RescueTime vs. time-lapse video) $p < .05^{*}, p < .01^{**}, p < .001^{***}$. Row 2: Metrics analyzed by time period (first two weeks vs. second two weeks). Row 3: Interaction plots. The interaction between condition and the order of conditions was statistically significant for all metrics. Arrows indicate the order of conditions for each group. For example, the TL-first group was in the time-lapse video condition for the first two weeks, followed by the RescueTime condition for the two subsequent weeks. Note that the y-axes on the interaction plots have different scales from the graphs in the other two rows.

In contrast, the dashboard visualization in RescueTime does not offer workers a means of recognizing what they may need to complete in the future.

4.2.4 ***Fostering a Sense Of Achievement and Well-Being.*** Many participants (11/15) specifically mentioned that they gained a strong sense of accomplishment in reviewing how much progress they had made after watching time-lapse videos. Watching these outcomes made them feel highly satisfied with themselves, and this method could even motivate them to be more productive in future work. Participants explained that the vivid visual information available in time-lapse videos had a bigger impact on seeing what they had done compared to the numeric summary provided by RescueTime. *"[Time-lapse videos] emotionally give me more shock. It will force me to do some reactions. The feeling is more strong." (P14)*

Writing and coding are two common computing tasks mentioned frequently by participants when asked about their primary work during the study. People claimed that watching their documents grow in length and seeing their programs improve iteratively made them feel satisfied and fulfilled.

> *[P5] "[On time-lapse videos] And I think especially when you see yourself actually focus on a task, like writing an email or writing an academic paper or whatever. If you see yourself on that screen for a while, you're just like,*

> *Wow, I was doing focused work... That was actually pretty nice to see writing happen in real time. Really big sense of accomplishment to see."*

> *[P13] "I feel the time-lapse video provided a lot of really rich information for me. When I was doing coding. So what I see from the time-lapse video is, you know, the code and some quick changes. Also, to see the [program] system features changes."*

Witnessing how they were progressing on tasks and that their time was well-spent on the right track were two significant sources of a sense of accomplishment.

In a similar vein, 8 participants (out of 15) recognized that watching time-lapse videos could enhance their well-being by facilitating better contextualized self-reflection. For example, P1 used to blame themselves for their inability to finish planned activities.

> *[P1] "I found that I only read two papers, but I was supposed to read three based on my yesterday's plan. This made me feel depressed and demotivated for not being able to finish my work. Later, when I went back to my videos, I found I was actually doing lots of searching on these papers, related work and spending more time on understanding their models, math formulas. I know I really did something and that's good. Then I stop blaming myself like that."*

Given the more detailed nature of time-lapse videos, participants were able to examine the challenges they experienced and feel relieved about the pressure to accomplish a specific volume of tasks.

4.2.5 ***Participants Discovering Previously Unknown Habits***.

Many participants (8/15) expressed that they became aware of unnoticed behaviors from time-lapse videos, but not from RescueTime. While numbers and graphs may be easy to read, identifying behavioral patterns in them can be difficult. Compared to the conventional dashboard reports in RescueTime, time-lapse videos made it easier for individuals to recognize their previously unnoticeable behavior patterns, such as frequent distractions and chatting too much on social media.

> *[P5] "[In response to a question that asked what they found surprising (Q5)] For example, watching videos for relaxing. I realized that I actually spent much more time than I thought in watching videos, like YouTube. It is beyond my expectation."*

One interesting finding is that while the time-lapse videos were limited to recording activities that occurred on participants' computer screens, participants could still recognize periods when they were not working on their computers, such as times when they were distracted by phones or other people, from seeing the same frame repeated without change in a time-lapse video. These unchanging screenshots reminded them that they were away from their computing tasks.

> *[P2] "I think my screen was sometimes just, like, in one frame. And I wondered, like, has the video paused or something? But it was not, like, it was just idle for a while. And then because I was on my phone.""*

One participant (P9) discussed that they did not know they had invested superfluous time in scheduling their plans on Google Calendar and to-do list applications.

> *[P9] "[When watching time-lapse videos] I noticed that I spend a lot of time in scheduling. Because I spent some time in the morning to schedule the whole day. But during the day, I keep occasionally open the calendar and try to add something more and more. This is something I could not be aware of before."*

In general, we learned that the participants were able to learn more about how they work (or do not work) from the history of rich visual cues available in time-lapse videos, demonstrating that time-lapse videos can help knowledge workers comprehend personal struggles they have around productivity and uncover rational explanations to interpret low-productivity behaviors. Meanwhile, our results suggest that it is difficult for users to understand their behaviors from a summary like that provided by RescueTime, as their behaviors are hidden in numbers, bars, and lines. In that regard, P6 mentioned that *"I just ignore most of these numbers on RescueTime easily."*

4.2.6 ***Time-lapse Videos Effectively Motivated Behavior Changes***.

In the interviews, most participants (14/15) articulated that they had changed or had inclinations to change their behaviors due to self-reflection under *both* conditions. RescueTime categorizes applications based on pre-defined productivity levels (productive, neutral, distracting) and presents summaries with different colors, such as blue and red. Participants who used RescueTime said that they changed their behaviors by prioritizing increasing productive activities and decreasing entertainment engagements. However, while the dashboard summaries enabled them to formulate clear goals, using RescueTime did not give them a detailed view of how they got distracted.

In the meantime, while the time-lapse videos did not offer clear summaries of users' productivity, it is noteworthy that participants were able to differentiate between activities that benefited their productivity and well-being. Participants raised the point that screenshots gave them effective feedback that motivated or even pushed them to change behaviors. The following comments from P14 summarize the power of time-lapse videos compared to RescueTime.

> *[P14] "I think it is because the video gives me more strong feeling because previously, even though RescueTime told me that I use social media for how many hours, it's not that powerful—but looking at the time-lapse videos, I cannot refuse to notice that."*

Another participant (P13) mentioned that tracking their computer activities and doing the following self-reflection tasks increased their self-awareness of past activities and made them more accountable for future work.

> *[P13] "It makes me responsible because, like, I thought that it's my duty... with that responsibility, I also get very responsible to my own work ... for example, I'm making a schedule of Monday on Sunday, whatever I'm going to do on Monday, I write it on the paper and make it in the mind. You know, like a good kind of responsible. So these*

are your tasks. You have to do this. So it also applies to my own work."

Grounded in their perceptions and cognitions, participants not only shifted their behavior toward high-productivity goals, but also shifted their perceptions of work.

4.2.7 ***Time-Lapse Video Watch Party.*** Among our 15 participants, two happened to be a couple that signed up for the study together. Their feedback shows that they discovered opportunities for socialization and sharing in their personal time-lapse videos. These two users mentioned that they were excited to share their time-lapse videos with each other and enjoyed the time spent watching them together. During the study, these participants mentioned that they had better conversations on common topics and learned more about each other from their daily activities.

[P2] "And then by watching those videos can help give us a time to have common interests or have a common conversation, like a conversation on a common thing that we all do. So it creates a common hobby like to us. And then because we work on different stuff and he sometimes interests interesting, like have interest in what I was doing the day. And I also want to know like what tasks he did today. And sometimes I'll be like, I'll stop here and then what is this? What is this like."

[P8] "We watch it together. She watched my video and I watched her video, and... It is really exciting to watch this video to learn more about us. Sometimes we communicate with each other what we did during the past day. And then we watch the video together. It's exciting."

This shareable activity seemed to motivate these two participants to have more meaningful conversations about their work lives that they were willing to share with each other.

4.2.8 ***RescueTime Complementing Time-Lapse Videos.*** While participants did identify some drawbacks of time-lapse videos, they also found ways to overcome these drawbacks by leveraging RescueTime. One common suggestion from our participants was for there to be some kind of statistical summary or results attached to the time-lapse videos, such as time stamps and application metadata.

[P3] "I feel like both quantitative things and... and visualizations are helpful, but they need to be combined to have a better sense of the productivity during the day."

[P8] "Like, if I can learn how much time I spend on different tasks in the video, if it can have some summary [of] that. After you watch all the videos, then give a summary."

Similarly, participants suggested that augmenting time-lapse videos with metadata would improve their effectiveness. For example, individuals mentioned highlighting specific frames or utilizing thumbnails per application to emphasize some screenshots, which could help them quickly identify previous tasks on which they spent a significant time.

Overall, many participants expressed interest in continuing self-reflection in the future with the help of time-lapse videos, RescueTime, and other self-tracking applications. Through this study, most participants benefited significantly from reviewing their recorded activities and learning new skills to improve multiple life factors.

5 DISCUSSION

In this section, we discuss the findings and implications of using time-lapse videos and existing solutions for facilitating self-reflection, behavioral change, and productivity enhancement.

5.1 Time-Lapse Videos Facilitate Productivity Gain and Contextualized Self-Reflection

While using time-lapse videos did not significantly affect participants' Productivity Pulse, which is an objective measurement, the participants' had perceptions of increased productivity in the time-lapse video condition. In addition, their perceived effectiveness was higher in the time-lapse video condition than in the RescueTime condition.

The increases in perceived productivity and perceived effectiveness can be attributed to the contextualized information in the time-lapse videos, as pointed out during the interviews. Participants might have understood a qualitative aspect of their productivity coming from the rich visual history. This result aligns with Fleck and Fitzpatrick's argument that visual recording could offer extra perspectives to understand events [26]. In particular, our work addresses one of the barriers identified by Collins et al. by providing contextual information in personal informatics (PI) [12].

Our work demonstrates how time-lapse videos can effectively facilitate self-reflection. Rosenberg and Peterson's study, which utilized time-lapse videos in an educational context, also yielded similar results in a quantified manner: the group with time-lapse video reflection produced a lengthier reflection document as measured by word count [61]. We extend their work by providing qualitative insights into how the participants found time-lapse videos valuable, as well as quantitative evidence of perceived value compared to typical visualization approaches (e.g., a dashboard summary in RescueTime).

One underexplored facet of time-lapse video is whether it may be more efficient than other self-tracking tools which users easily lose interest in and find it difficult to remain engaged with [24]. In a previous study, while RescueTime was helpful in raising self-awareness of users' distraction on social media, low engagement was a major barrier [13]. Our participants, although instructed to check their time-lapse videos daily, showed great interest in watching the videos, even when doing so took a few minutes. The engaging nature of time-lapse videos may be a benefit unique to them and missing from modern PI tools [7]; this could potentially provide a novel way to foster long-term engagement with productivity data.

5.2 The Order Matters: Time-Lapse Videos Facilitate Sense-Making in Traditional PI Tools

Interestingly, we observed consistent learning effects and stronger ordering effects for all the metrics we measured. The learning effects indicate that all performance metrics in the second two weeks are significantly higher; one potential interpretation is that simply using PI tools for a longer period of time may positively affect these metrics. However, this interpretation conflicts with an existing study; Kim et al. found that simply using productivity tools

for an extended time did not produce a significant effect, and the length of usage did not impact productivity [40], suggesting that such a long-term effect (the first interpretation) may not exist. An alternative explanation could be that using two different applications is complementary, so the metrics in the second two weeks outperformed the earlier metrics as participants experienced both types of application.

The participants' feedback supports this interpretation; as stated in 4.2.8, participants expressed a desire to use both tools simultaneously as it could enhance productivity. This implies that time-lapse videos may not simply "replace" current methods but instead complement existing self-tracking tools by offering additional context to facilitate actionable reflection.

However, the learning effects do not account for the ordering effects. The ordering effects demonstrated that having seen RescueTime before using time-lapse videos was much more useful than the other way around and yielded gains in all metrics. Most notably, this particular order had a significant effect on the Productivity Pulse. The fact that they used time-lapse videos could have helped the participants make sense of their dashboard summaries in retrospect, eliciting asynchronous awareness of how and why and facilitating actionable reflection [69]. In the meantime, using time-lapse videos first might not have been effective because participants may have found more concrete motivation and goals in the dashboard summaries (e.g., less distraction, more working hours). Another way to interpret the result is that the RescueTime summary can effectively help users recognize problems, while using time-lapse videos can give them ideas on how to address those problems and improve their productivity.

A previous study utilizing RescueTime-like time-tracking software in the field reported that 'software [time-logging] helped them gain insights into time management, but it did not assist in altering their time management practices [56]. The authors suggested the necessity of a sense-making system to aid users in changing their behaviors and making Personal Informatics (PI) more actionable. We firmly believe that time-lapse videos offer an explainable solution to the concern highlighted by the authors, and further research will be required to validate the effectiveness of this comprehensive approach and the sense-making role of time-lapse videos.

5.3 Positive Personal Informatics Promoted via Time-Lapse Videos

One consistent finding, as highlighted in 4.2.4, is that participants discovered more positive means of understanding their work history (e.g., sense of achievement, reduced self-blame) from watching time-lapse videos compared to reviewing their work through RescueTime. Our quantitative results also confirmed this positive view on productivity; perceived productivity was higher when using time-lapse videos, even when objective measures (i.e., Productivity Pulse) did not show a statistically significant difference. The participants' positive perceptions of their productivity potentially hold significant weight, particularly in relation to existing literature that has often emphasized the negative emotions stemming from personal informatics, such as feelings of failure, guilt, and stress [21, 23]. Previous studies involving images and recordings have shown a similar positive impact on users' mental health; The groups that revisited their event logs with pictures expressed more positive emotions than those who logged their emotions without review or reflection [35]. Similarly, previous work found that replays of creative writing found authors recognizing their habits, reflecting on their practices, and fostering empathy with other writers [5]. The temporal dimension — the interval between reflection and recording — can also affect how much it can modulate the positive effects of video-assisted reflection; proximal and distal effects of time-lapse video can vary [67].

5.4 Design Considerations for Personal Informatics

Based on the findings from the study, we suggest the following design considerations that can apply to time-tracking or self-tracking tools in a productivity context.

Including visual recordings can facilitate context recovery. Knowledge workers can access comprehensive data that facilitates behavioral changes and increases productivity in the form of quantitative summaries and relevant contextual cues—such as pictures, icons, screenshots, thumbnails, screen recordings, or time-lapse videos. If reviewing real-time visual recordings proves too time-consuming, time-lapse videos can serve as a shorter, yet sufficient alternative, providing essential context.

Understanding quantitative results first increases the utility of contextual information. In providing contextual information, such as time-lapse videos, there exists a prerequisite that users understand their problems or goals quantitatively. Merely providing qualitative insights may not be as effective as a more comprehensive approach.

Contextual information can encourage positive reflection. When encouraging users to reflect on their data, it can be effective to include contextual cues that allow them to review their data from various angles to facilitate positive reflection. For example, a decrease in productivity can be stressful; in the event of such a decrease, qualitative prompts utilizing images could be provided as a supplement to the quantitative information, offering an opportunity to understand the context underlying the quantitative results and promoting a more positive understanding of the user's data.

Associating data with meaningful units helps. Metadata collected from personal informatics tools might not always serve users effectively in making sense of their data. For instance, within a productivity context, tasks represent more meaningful units of work compared to simply tracking application usage or even categorizing states (e.g., productive/distracting), which might lead to miscategorization issues as highlighted in prior research [12]. It thus becomes crucial to empower users by allowing them to associate raw metadata with units that align with their mental models. That said, these meaningful units may not always be readily available, and supplying them could necessitate prediction or manual annotation. Fleck and Fitzpatrick's framework suggests that annotation can facilitate what they term Reflective Description and Dialogic Reflection [26].

Personal informatics results can facilitate social interaction. We have again confirmed the potential for social interaction in PI contexts, even to the extent of collectively watching time-lapse videos. Previous literature has highlighted how users derive value

from comparing data with individuals they feel close to, effectively sustaining their self-tracking practices [49, 51, 53]. In our study, we discovered that contextual information collected by a personal informatics tool can serve as a social facilitator. However, developers need to carefully consider the degree to which data can be shared and the format in which it can be shared. For instance, time-lapse videos might easily contain private information.

6 LIMITATIONS AND FUTURE WORK

One limitation of this study lies in the participant demographics, primarily consisting of graduate students (12 out of 15), attributed to the unavailability of installing custom software on work computers for many users. Despite this, we argue that studying graduate students is relevant, as they face challenges similar to those encountered by knowledge workers in general. They handle some tasks independently, such as research, while external factors, such as class assignments, research/teaching assistant duties, and conference deadlines, significantly shape the nature of other tasks. Moreover, graduate students may have greater task management needs due to ambiguous work-life boundaries: they often lack regular working hours and designated workspaces, and they may not receive any clear financial compensation for working overtime. Meanwhile, recent trends, especially during the COVID-19 pandemic, have allowed knowledge workers similar flexibility in choosing when and where they work [71]. In this regard, we believe that the study's findings remain pertinent and representative of modern knowledge workers.

Another limitation highlighted by our participants regarding time-lapse videos is their failure to account for diverse computing environments, such as using multiple devices across various locations. Knowledge workers often use multiple computers in different setups (e.g., a dual-monitor desktop computer in one location, a laptop in another, and a tablet on the go). We see potential for future work to explore the possibility of a cross-location work management tool that can seamlessly connect different computers not only through time-lapse videos, but also by restoring work resources.

Lastly, as previously mentioned in 5.3, our study only tested daily reflection, reflecting on data from one day ago. However, the impact of varying time intervals and review frequencies on facilitating or hindering self-reflection remains unclear. Therefore, comprehending the medium- and long-term effects of time-lapse video-based self-tracking is essential [67]. We consider this an avenue for future exploration for studying the enduring impact of incorporating time-lapse videos alongside other tracking tools.

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A DAILY SURVEY QUESTIONS

(Q1): Could you summarize tasks that you worked on or completed on the day of the time-lapse videos/RescueTime you reviewed?
(Q2): How many hours do you think that you have worked on the day of the recorded time-lapse video/RescueTime?
(Q3): I was productive on the day when time-lapse videos/RescueTime were recorded. (A 7-point Likert-Scale questions, 1 = Strongly Disagree, 4 = Neutral, and 7 = Strongly Agree)
(Q4): It was helpful to use time-lapse videos/RescueTime to understand my productivity on the day. (A 7-point Likert-Scale questions, 1 = Strongly Disagree 4 = Neutral, and 7 = Strongly Agree)
(Q5): What did you learn about how you spend time from time-lapse videos/RescueTime?
(Q6): Based on the time-lapse videos/RescueTime, how do you think you can improve your productivity or any other values that you are interested in (e.g., work-life balance, productivity, well-being)?
(Q7): Based on reviewing the time-lapse videos/RescueTime, what do you learn about what you have to do tomorrow?

B POST-STUDY INTERVIEW QUESTIONS

(Q1): Could you please describe briefly about your primary work during the study?
(Q2): Do you have a specific routine or time period to reflect your past computer activities?
(Q3): What is your general comment about the self-tracking process?
(Q4): What do you think you have learned from watching time-lapse videos or reading the daily report in RescueTime? What kind of reflection were you able to have from it?
(Q5): Was there anything surprising to you from the time-lapse videos/RescueTime that you saw?
(Q6): Does watching time-lapse videos or reviewing RescueTime reports make you feel stressed, anxious, or satisfied anyway?
(Q7): Do you think you have changed your behaviors in any way based on the reflection you had with time-lapse videos/RescueTime? If not, do you have any ideas on how you want to change your behaviors based on recorded personal data?
(Q8): Overall, how do you think time-lapse videos/RescueTime can help you be more productive or accomplish your personal productivity goals?
(Q9): Compared with RescueTime and time-lapse videos, what do you think about these two methods? Any pros and cons? Do you have any suggestions for improving the current design of time-lapse videos?