Focus Time: Effectiveness of Computer Assisted Protected Time for Wellbeing and Work Engagement of Information Workers

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Having little time for focused work is a major challenge of information work. While research has explored computing-assisted user-facing solutions for protecting time for focused work, there is limited empirical evidence about the long-term effectiveness of these features on wellbeing and work engagement. Towards this problem, we study the effects of automatically scheduling time for focused work on people's work calendars using the Focus Time feature on Outlook calendars. We conduct an experimental study over six weeks with 15 Treatment and 10 Control participants who responded to survey questions on wellbeing and work engagement throughout the study. We find that the Treatment participants showed significantly higher wellbeing, including increased excitement, relaxation, and satisfaction, and decreased anger, frustration, tiredness, and stress. We study the needs, benefits, and challenges of scheduling focus time, and discuss the importance of enabling mechanisms for focused work in organizations and design recommendations for tools supporting focused work.

Additional Key Words and Phrases: focus work, workplace, wellbeing, experimental study, time protection, information workers

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1 INTRODUCTION

Managing time better at workplaces is one of the key interests of researchers and practitioners [37]. Workplaces have forever been evolving, and in recently, we have seen an increasing prevalence of remote and hybrid work as stimulated by the COVID-19 pandemic [33, 103]. While such work settings have enabled more flexibility and remote collaborations for information work [115], these have also added complexities in terms of the increased number of meetings, longer work hours, blurred work-life boundaries, more multi-tasking, and disrupted work-life balance [33, 58, 95]. These complexities have simultaneously added limits to an individual's ability and time to do self-focused work and affected their productivity and wellbeing [21, 105]. However, the importance of enabling individuals to do self-focused work cannot be overlooked by organizations. Past research in organizational behavior has shown that organizational performance depends on the right number of workers, proper identification of required skills in the workforce, and motivated workers with positive behavior geared towards improving the organization's performance [44]. In particular, the ability to concentrate, communicate and move quickly between individual and collaborative work has been found to significantly improve the work quality of individuals, which in turn improved the quality of organizational outcomes [85].

In the context of individual work, costs of task switching and disruptions due to notifications depletes productivity and negatively impacts wellbeing of individuals [7, 28, 47, 59, 65, 73]. Kushlev and Dunn found that limiting email checking

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reduced stress, and Mark et al. noted that self-interruptions of emails lead to better productivity than notification-based interruptions. Other work found blocking notifications enhanced focused work and reduced multitasking and distractions [69, 74]. Research has also noted the importance of focused work in improving productivity and wellbeing [43, 69, 90]. Focused work is found to associate with cognitive absorption, which not only significantly impacts an individual's deep involvement, learning [1], and creativity [19], but also helps them be more relaxed and perceive greater control [62, 88].

To help individuals dedicate more time to focused work, HCI research has explored methods such as better notifications, time-protection tools, and other interventions [20, 38, 46, 48, 54, 57, 107]. However, there is a lack of evidence about the in-practice effectiveness and utility of these tools, i.e., how people actually use them in the wild and if these tools achieve the desired goals in the long-term. Towards this goal, this study examines the usage of a tool (Viva Focus Time) that programmatically schedules focus time on an information worker's work calendar and pauses notifications during these periods so that they can dedicate these times for focused work. We leverage validated metrics from organizational behavior research to measure the impact of automatic scheduling of focus time on the eudaimonic wellbeing in the workplace, or the wellbeing derived from realizing one's potential [16]. Our work asks the following research questions:

RQ1: Immediate wellbeing and work engagement changes: What are the expected and observed wellbeing changes of scheduling time for focused work in the short term (each week)?

RQ2: Overall impact on wellbeing and work engagement: Does scheduling focus time impact long-term workplace wellbeing and work engagement?

RQ3: Use, benefits, and challenges of scheduling focus time: How is the time set aside for focused work used in practice, and what are the perceived benefits and challenges of protecting time as such?

To answer these questions, we conducted a six-week long study with an experimental (Treatment) group who used the Focus Time feature for those six weeks to schedule a time to focus on their calendar on a daily basis to the extent possible. We collected their subjective feedback about their experience, and compared responses on validated wellbeing and work engagement measures before and after the study. We also compared the Treatment group with a Control group that did not use the Focus Time service but filled out the same questionnaires.

We find that, in comparison to the Control, the Treatment individuals showed an increase in their weekly feelings of bursting with energy and a decrease in weekly feelings of stress and difficulty in detaching from work. The Treatment individuals also showed improved wellbeing in several metrics, including affective attributes like anger, excitement, relaxation, frustration, satisfaction, and tiredness, and workplace engagement attributes such as eagerness to go to work, happiness during intense work, learning, and resilience. These observations point out improvements in the wellbeing of Treatment individuals following the use of Focus Time feature. We also examine what people did during the focus time periods and what are their needs, benefits, and challenges about using this feature. Our results suggest the importance for organizations to facilitate their employees to set aside time to focus on their calendars to improve the overall long-term wellbeing and productivity of the information workers. We discuss the implications of this research in designing tools to enable better use of focus time and how to overcome the current challenges with missing notifications and high-priority communications during focus time and emphasizing the transparency about using the Focus Time service on digital calendars.

2 RELATED WORK

2.1 The Role of Individual Work on Organizational Outcomes

An individual's wellbeing in the workplace translates to individual, collective, and organizational success [55]. However, the importance of nurturing individual experiences to influence desired organizational outcomes is often overlooked. Green studied how different individual, interpersonal, and organizational factors, including organizational policies, employee benefits, and performance appraisals associate with organizational outcomes [42]. Council elucidate how the five processes of coordination, problem-solving, the proper focus of attention, organizational evolution and motivation operating together in a congruent and reinforcing manner can impact how individual productivity contributes to organizational productivity.

In addition to productivity and efficiency-related outcomes, multiple facets of wellbeing have been shown to manifest in workplace settings. Workplace wellbeing involves the interaction between individual characteristics and organizational and environmental factors [8]. Research has emphasized the focus on workplace stress—stress that arises if the demands of an individual's roles and responsibilities exceed their capacity and capability to cope [24]. Workplace stress leads to not only impaired decision-making, productivity, and job satisfaction but also significant business costs—approximately USD 300 per year in the U.S. [9]. De Neve et al. proposed the importance of considering subjective wellbeing in the workplace as a coarse construct that leads to objective benefits across important life domains of 1) health and longevity, 2) income, productivity, and organizational benefits, and 3) individual and social behaviors [36].

Given the above considerations, employers have critical incentives to support their employees' needs and wellbeing. This work bears implications for multiple stakeholders for not only showcasing the importance but also in informing approaches and enabling mechanisms to support wellbeing in the workplace.

2.2 Supporting Workplace Wellbeing and Engagement for Individuals

Organizational science research has studied approaches to improve workplace wellbeing and engagement for individuals [8, 17]. HCI and UbiComp research has subsequently explored approaches to proactively support workplace wellbeing through sensing and computing-assisted technologies [11, 46, 57, 77]. The ubiquity and widespread use of smartphones and wearables have enabled the collection of longitudinal and dense human behavioral cues at scale [109, 110]. Prior research has used multimodal sensing through smartphone, wearable, bluetooth, and wireless sensors to try to infer job performance [82], mood and cognition [10, 11, 70, 97], social interactions [15, 76], organizational personas [29], organizational fit [32]. Mark et al. examined how email interactions relate with workplace stress and productivity [73]. Another work [71] leveraged digital activities of information workers to understand work patterns and attentional states [71]. Further, with the widespread use of online and social media technologies, prior research has argued that such data can serve as longitudinal, historical, and verbal passive sensors [91]. Different forms of digital data, including online social interactions, have enabled examining work engagement [84, 100], mood and affect [35, 101], organizational relationships [18, 40, 83], role constructs [93], organizational culture [34, 113], and job satisfaction [61, 94].

Recently, Howe et al. explored using just-in-time interventions for reducing stress of information workers. Overall, as the workplace has transitioned and evolved in recent years, also stimulated by the pandemic, with the increasing prevalence of remote and hybrid work, computing technologies are getting more and more embedded in the workplace [12, 33, 89, 114]. The fourth wave of industrial revolution [98] sees the work and workplace to change tremendously, and new technologies are fusing the physical, digital, and biological worlds [63].

Building on the above body of work, this paper helps provide empirical insights into the efficacy of a computer-assisted time-management tool toward wellbeing and work engagement of information workers.

2.3 Computer Assisted Time Management at Work

Time management for different activities is a form of planned behavior [64], and helps individuals be in control of their time and reach expected outcomes better. Time management is one of the key components of information work—information workers must constantly schedule and manage their time between meetings, work hours, and work-life balance [23]. Mark et al. noted how information work comprises of work fragmentation—short tasks and tasks switching rather than continuous activity [67]. Multi-tasking and disruptions because of notifications and interruptions can lower a worker's wellbeing, productivity, and work effectiveness [4, 21, 45, 68]. Mark et al. noted how multitasking activities can cause increased stress [75]. In addition, time for self-focused work gets deprioritized or is done only after work hours [80]. Traditionally, workers have used notebooks and to-do lists to manage time better to plan their day [39]. Similar approaches have transcended into using digital calendars and digital to-do and task management lists in more recent times [2, 79, 99]. These tools enable individuals to record personal and collaborative events, as well as to support reminders, meeting schedulers, and invitations.

One of the most common computer-assisted time management is through Pomodoro technique, which enables a worker to box a fixed time for mindful work followed by short breaks [22, 111]. This technique was also expanded as PomodoLock which blocked distractions in fixed boxes of time [52]. With the ubiquity of smartphone and mobile technologies, various approaches have been explored to help time-management, such as lockout mechanics [53] and vibrational feedback [86]. Recently, Tseng et al. built a conversational agent to help manage workers' distractions by negotiating boxes of time through blocking websites to help reduce workplace stress [107]. Other research have designed and explored conversational agents to minimize distractions and encourage focused work of information workers [43, 54]. Commercially, Viva Focus Time service provided on Microsoft Outlook calendars automatically schedules time blocks for focused work from available slots on an individual's outlook calendar [81]. This service essentially blocks notifications and distractions during these time windows and provides different suggestions and reminders that workers could adopt during their work day. Recently, Das Swain et al. examined the potential impact of Viva Focus Time on an information worker's schedule, to find that such a service can help information workers to rearrange their work schedules and and effective reduction in work activity [31].

Building on the above body of work, we conduct an experimental study where participants respond to weekly survey questions on wellbeing and work engagement, and we longitudinally observe the changes in the Treatment group against a Control group. In addition, we ask the participants about the needs, benefits, and challenges of using this service. This paper examines the in-practice utility and effectiveness of a computer-assisted time protection service (Viva Focus Time) towards the wellbeing and engagement of information workers. Our work also provides recommendations for organizational practices and designing tools that can help support self-focused work in the workplace.

3 STUDY AND DATA

3.1 Automated Service for Scheduling Focus Time in Work Calendar

We investigate the use and effectiveness of an automated service that schedules time on an information worker's work calendar. We work with Focus Time [81] service that comes integrated with Microsoft Outlook's enterprise solutions. When someone enables Focus Time, they can use it to regularly block time for self-considered top-priority work by

Table 1. Demographic distribution of the study participants.

Question	Treatment	Control
Age	20-30: 2, 30-40: 9, 40-50: 2, 50-60: 1, 60-70: 1	20-30: 3, 30-40: 1, 40-50: 5, 50-60: 1
Gender	Man: 8, Woman: 7	Man: 4, Woman: 5, Non-binary: 1
Education Level	College graduate: 9, Post-graduate: 6	Some college: 1, College graduate: 4, Post-graduate: 5
Household Income	$50K-$75K: 1, $75K-$100K: 3, $100K-$125K: 3, $125K-$150K: 3, $150K+: 7	$75K-$100K: 3, $100K-$125K: 2, $125K-$150K: 2, $150K: 3
Industry	Financial: 3, Software: 3, Telecom.: 1, Automative: 2, Technology: 1, Sales: 1, Consulting: 1, Real Estate: 1, Service: 1, Healthcare: 1	Financial: 3, Healthcare: 2, Technology: 2, Manufacturing: 2, Legal: 1

scheduling up to four hours every day to focus. During these Focus Time slots, they appear "busy" on their calendars, and the service can additionally silence notifications of chats and emails on their desktop / mobile work device. For the study, we asked individuals who had not used the service before to use it to schedule time to focus on their calendar and see if such a computing-assisted time protection feature would help their wellbeing and work engagement.

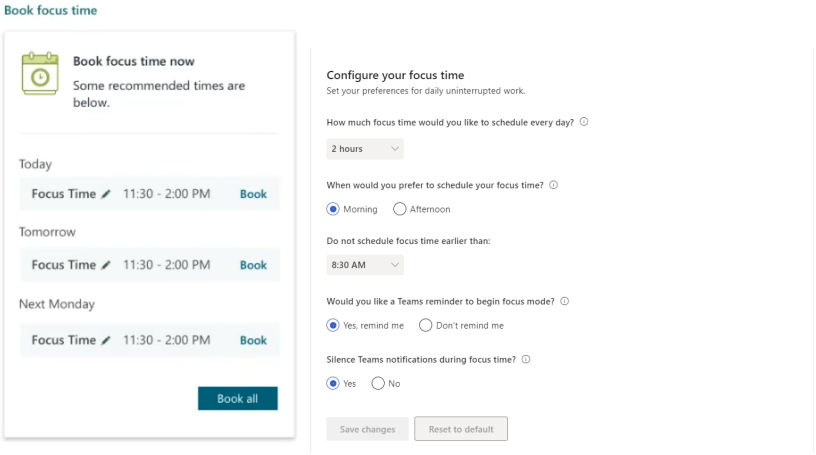

Fig. 1. Example figures to demonstrate configuring and using Focus Time feature on Outlook calendar.

3.2 Recruitment

Our study included two groups of participants — 1) Treatment participants, who would be asked to enable and use Focus Time feature on their work calendars, and 2) Control participants, who would not use Focus Time feature. Both groups responded to the same surveys with minor modifications— an entry survey, weekly check-in surveys, and an exit survey that includes questionnaires on wellbeing and work engagement.

We conducted our study with U.S.-based information workers through the Dscout platform. Dscout is a qualitative remote research platform [112], where individuals can sign-up as "scouts" to participate in various research studies (or "missions") posted by research and product teams. First, we included a screening survey to filter in eligible participants. The screening survey included questions related to participant demographics (age, gender, education, ethnicity, employment status, income) and employment attributes (employment status, industry, type of work, computer use, availability of Focus Time feature on workplace email and calendar, etc.). After the screening survey was up on the Dscout platform for over a week, we received 1,579 responses, among which—47 individuals satisfied some core requirements for our study—1)they responded "all or most of my day is spent on computer", 2) they had access to the Focus Time feature, 3) had never used it before, and 4) were willing to try it out for the study. From these 47 individuals,

Table 2. List of survey questions on worker wellbeing and productivity and their occurrence in the study.

Keyword	Question	Response	When?
Angry	Over the last 30 days, how often have you felt **angry** at work?	1 (never) to 5 (always)	Entry, Exit
Anxious	Over the last 30 days, how often have you felt **anxious** at work?	1 (never) to 5 (always)	Entry, Exit
Excited	Over the last 30 days, how often have you felt **excited** at work?	1 (never) to 5 (always)	Entry, Exit
Relaxed	Over the last 30 days, how often have you felt **relaxed** at work?	1 (never) to 5 (always)	Entry, Exit
Frustrated	Over the last 30 days, how often have you felt **frustrated** at work?	1 (never) to 5 (always)	Entry, Exit
Satisfied	Over the last 30 days, how often have you felt **satisfied** at work?	1 (never) to 5 (always)	Entry, Exit
Tired	Over the last 30 days, how often have you felt **tired** at work?	1 (never) to 5 (always)	Entry, Exit
Tired after waking up	I feel tired as soon as I get up in the morning and see a new working day stretched out in front of me.	1 (never) to 7 (always)	Entry, Exit
Self-fulfillment	I have achieved many rewarding objectives at work	1 (never) to 7 (always)	Entry, Exit
Personal growth	I view my work as contributing to my personal growth	1 (absolutely untrue) to 5 (absolutely true)	Entry, Exit
Meaningfulness	I have a good sense of what makes my job meaningful	1 (absolutely untrue) to 5 (absolutely true)	Entry, Exit
Bursting with energy	At work, I feel bursting with energy.	1 (never) to 7 (always)	Entry, Weekly, Exit
Carried away	I get carried away when I am working.	1 (never) to 7 (always)	Entry, Weekly, Exit
Continue long work	I can continue working for very long periods at a time.	1 (never) to 7 (always)	Entry, Weekly, Exit
Eagerness to go to work	When I get up in the morning, I feel like going to work.	1 (never) to 7 (always)	Entry, Weekly, Exit
Forget everything else	When I am working, I forget everything else around me.	1 (never) to 7 (always)	Entry, Weekly, Exit
Happy at intense work	I feel happy when I am working intensely.	1 (never) to 7 (always)	Entry, Weekly, Exit
Stress	At the end of the week, I felt stressed.	1 (strongly disagree) to 5 (strongly agree)	Weekly
Strong and Vigorous	At work, I feel strong and vigorous.	1 (never) to 7 (always)	Entry, Weekly, Exit
Time flies at work	Time flies when I am working.	1 (never) to 7 (always)	Entry, Weekly, Exit
Work detachment difficulty	It is difficult to detach myself from my work.	1 (never) to 7 (always)	Entry, Weekly, Exit
Work immersion	I am immersed in my work.	1 (never) to 7 (always)	Entry, Weekly, Exit
Resilience	At my job, I am very resilient, mentally.	1 (never) to 7 (always)	Entry, Exit
Perseverence	At my work, I always persevere, even when things do not go well.	1 (never) to 7 (always)	Entry, Exit
Learning	I continue to learn more and more as time goes by.	1 (strongly disagree) to 7 (strongly agree)	Entry, Exit
Self-improvement	I see myself continually improving.	1 (strongly disagree) to 7 (strongly agree)	Entry, Exit
Worn out	I feel worn out at the end of a working day.	1 (never) to 7 (always)	Entry, Exit
Focus Time Quantity	For Treatment: How often did you use the Focus blocks set by the focus time plan? For Control: Please look at your calendar for the past 5 work days. How much time in total have you blocked for yourself to focus on heads-down work?	Open Textbox on hours	Weekly, Exit

we randomly selected a sample of 25 participants (15 for Treatment and 10 for Control). One Treatment and two Control participants dropped out in the first two weeks and were substituted with three other participants (also randomly selected from the same pool of 47 participants). Each participant stayed in the study for a period of six weeks in July and August 2022 and responded to an intake survey, weekly check-in surveys, and an exit survey. The compensation for completing the study included USD $100 for Treatment participants and USD $75 for Control participants. The difference in compensation is based on the notion that the Treatment group was asked to enable and use Focus Time on their calendars in addition to responding to the surveys. Table 1 presents the demographic distribution of the 25 participants who stayed for the entire study.

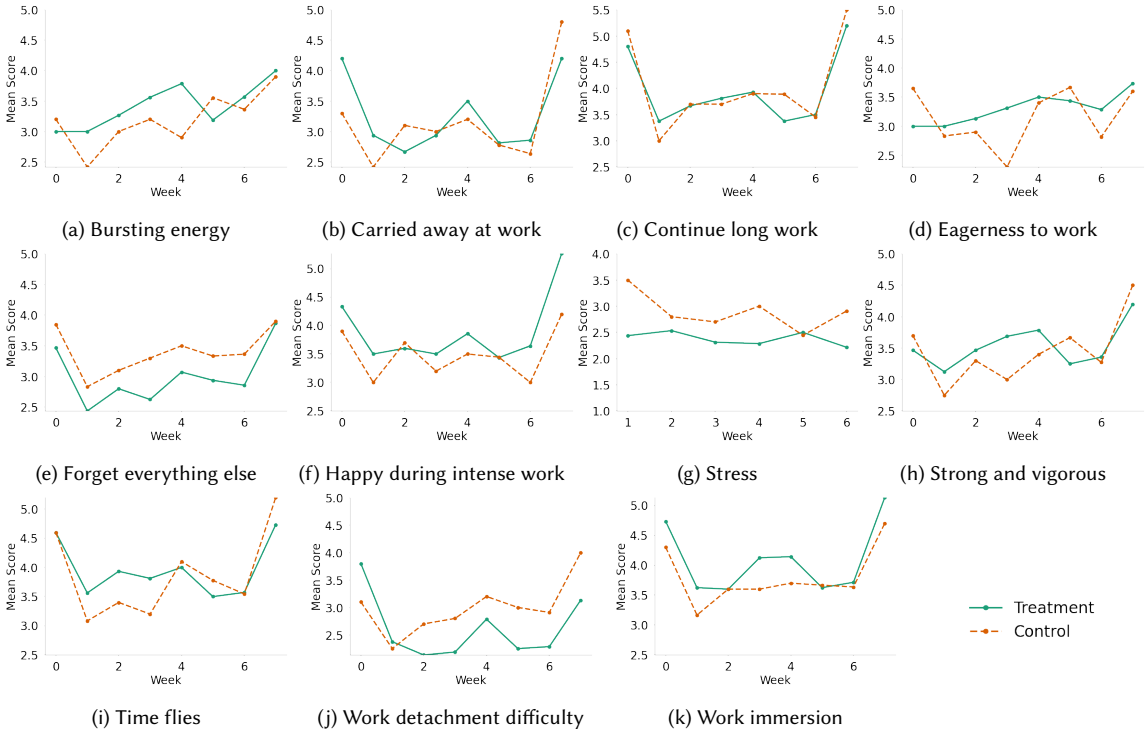

Fig. 2. Comparison of Treatment and Control individuals' weekly changes over the study (week 0 is intake and week 7 is exit).

3.3 Self-Reported Surveys

We designed our study to understand the effects of protecting time for focused work on calendars. We employed multiple surveys that measure an individual's wellbeing and engagement at work. These surveys were conducted at the entry (week 0), weekly (week 1 to 6), and exit (week 7) of the study. The surveys administered in week 0 collected baseline data on people's self-perceptions of workplace wellbeing and work engagement factors. The same survey was used in week 6, to see if six weeks of using automatically scheduled focus time for the treatment group resulted in any changes in the same factors. For survey questions, we draw on organizational research in the impact of focused work on eudaimonic wellbeing and workplace engagement-related constructs [1, 16, 19, 62, 88]. We adopted the survey questionnaires from the Utrecht Job Engagement Scale [96], Work and Meaning Inventory [104], and Job-related Affective Wellbeing scale [108]. Table 2 provides the survey questions administered at different stages of the study. The weekly surveys were geared towards understanding how well participants could focus at work that week and a few questions on wellbeing. In addition, the weekly and exit survey questions included qualitative and open-ended questions on what the participants did during the Focus Time periods and their perceived benefits and challenges with the service.

4 RESULTS

We examined the changes in workplace wellbeing and engagement measures during the course of the study for the Treatment and Control groups. First, comparing the differences in the two groups during intake of the study, we note that both the groups are well-distributed in demographic parameters (Table 1). We also compared the differences

in the intake survey for the two groups, which could be considered to be their baseline measures (before any study intervention was conducted). We conducted independent sample t-tests to compare the differences to find no significant difference across all the measures in Table 2, except a small significant difference in *frustrated* (t=2.35, p<0.05). The lack of significant differences across the majority of measures at the beginning of the study suggests that we had two balanced groups of individuals. The following subsections report our findings corresponding to each of our research questions.

4.1 RQ1: Immediate wellbeing and work engagement changes

Table 3. Summary of differences in wellbeing measures through weekly check-ins during the course of the study for Treatment and Control individuals, along with effect size (Cohen's d) and independent-sample t-tests (. p<0.1, * p<0.05, ** p<0.01, ***p<0.001).

	Treatment		Control				
Measure	**Mean**	**Std.**	**Mean**	**Std.**	d	**t-test**	**Interpretation for Treatment**
Bursting /w energy	3.38	0.86	3.05	0.89	0.38	2.33**	Treatment felt greater bursting with energy
Carried away	2.95	1.08	2.84	1.17	0.09	0.57	
Continue long work	3.60	1.06	3.58	0.87	0.02	0.15	
Eagerness to go to work	3.27	1.19	2.97	1.34	0.24	1.48·	Treatment were more eager to go to work.
Forget Everything Else During Work	2.78	1.04	3.23	0.97	-0.44	-2.66***	Treatment forgot lower about non-work
Happy During Intense Work	3.58	0.97	3.29	0.90	0.31	1.86·	Treatment were happier during intense work.
Stress	2.38	1.08	2.92	1.29	-0.45	-2.77***	Treatment felt lower stress.
Strong and Vigorous	3.44	0.93	3.21	0.95	0.24	1.48·	Treatment felt more strong and vigorous.
Time Flies	3.73	0.96	3.50	1.10	0.22	1.33	
Work Detachment Difficulty	2.33	1.09	2.79	1.44	-0.36	-2.24**	Treatment found it easier to detach from work.
Work Immersion	3.80	0.99	3.55	0.93	0.27	1.59.	Treatment were more immersed in work.
Work comparison							
Work Hours	42.36	6.91	41.69	7.60	0.09	0.56	
Work Hours Deviation from Norm	1.91	0.57	1.97	0.62	-0.09	-0.57	
Focus Time Quantity	2.60	0.57	2.34	0.76	0.39	2.45**	Treatment were able to dedicate more time to focus.

Towards RQ1, we examine how the wellbeing and work engagement measures temporally varied for the participants in each week over the duration of the study. Figure 2 compares the Treatment and Control individuals' weekly responses collected before and during the use of the Focus Time feature for six weeks. Appendix **??** shows the distribution of the responses in the Treatment and Control groups. These comparisons include the entry (week 0) and exit (week 7), wherever applicable. Table 3 shows a summary overview of these changes, including effect size (Cohen's d) and independent sample t-tests, revealing significant changes in several comparisons.

We find that the Treatment individuals show greater *bursting with energy* (d=0.38), *eagerness to go to work* (d=0.24), and *work immersion* (d=0.27), whereas lower *forgetting everything else during work* (d=0.44), *stress* (d=0.45), and *difficulty to detach from work* (d=0.36). We also note that there was no significant difference in the work hours and the (self-reported) deviation of work hours from typical work hours between the Treatment and Control individuals. So, the directionalities in measures indicate a positive short-term impact every week among the Treatment individuals than the Control individuals. The Treatment individuals also self-reported a better ability to dedicate time for focused work than the Control individuals; this plausibly validates the use of Focus Time—that the Treatment individuals were actually able to use the feature during the study period.

4.2 RQ2: Overall Impact of Focus Time on Wellbeing and Work Engagement

To study RQ2, we conduct a within-person examination of how the Treatment participants' wellbeing and work engagement changed at the end of the study compared to the beginning. We quantify the changes from the entry to exit of the study, and measure the average treatment effect (ATE) computed as the mean difference in changes in Treatment and Control groups. Table 4 summarizes the mean within-person changes in the Treatment group, along

Table 4. Summary of within-person changes in wellbeing measures from intake to exit of the study for Treatment individuals, along with Average Treatment Effect (ATE), and paired-sample t-tests (. p<0.1, * p<0.05, ** p<0.01, ***p<0.001). Bar lengths are proportional to ATE magnitude, and for significant rows, **pink** bars indicate **a decrease** in Treatment individuals' measure and **green** bars indicate an **an increase** in Treatment individuals' measure. The interpretations are only provided for statistically significant rows as per t-test; Length of **grey** bars indicate the magnitude of ATE in non-significant rows.

Measure	Mean δTr.	ATE	d	t-test	Interpretation for Treatment individuals
Angry	-0.53	-0.48	0.61	2.26*	Anger decreased
Anxious	-0.33	-0.93	0.47	1.16	
Excited	0.73	0.93	-0.92	-2.13*	Excitement increased
Relaxed	0.60	0.70	-0.95	-3.67***	Relaxation increased
Frustrated	-0.47	-0.52	0.75	2.82**	Frustration decreased
Satisfied	0.47	0.47	-0.51	-2.43*	Satisfaction increased
Tired	-0.47	-0.67	0.67	2.17*	Tiredness decreased
Bursting /w energy	1.00	0.30	-0.91	-3.62***	Bursting with energy increased
Carried away	0.00	0.02	0.00	0.00	
Continue long work	0.40	0	-0.24	-0.81	
Eagerness to go to Work	0.73	0.78	-0.48	-1.98.	Eagerness to go to work increased
Forget everything else	0.40	0.35	-0.25	-1.19	
Happy during intense work	0.93	0.63	-0.66	-1.79.	Happiness during intense work increased
Time flies during work	0.13	-0.47	-0.09	-0.32	
Learning	0.07	0.32	-0.05	-0.17	
Meaningfulness	0.20	-0.30	-0.16	-0.61	
Perseverance	0.20	-0.45	-0.23	-0.76	
Personal growth	0.40	0.50	-0.29	-1.38	
Resilience	0.87	0.67	-0.62	-2.48*	Resilience increased
Self-fulfilment	0.47	0.52	-0.33	-1.61	
Self-improvement	-0.20	-0.30	0.15	0.51	
Strong and vigorous	0.73	0.07	-0.71	-2.05*	Feeling strong and vigorous increased
Tired after waking up	-0.93	-1.03	0.61	1.90.	Feeling tired after waking up decreased
Work detachment difficulty	-0.67	-1.57	0.35	1.01	
Work immersion	0.40	0	-0.25	-1.87	
Worn out	-0.27	-0.22	0.19	0.55	
Working too hard	-0.13	-0.93	0.08	0.31	

with the ATE, Cohen's d, and paired-sample t-tests. Among affect categories, we find that the Treatment individuals show lowered *anger*, *frustration*, and *tiredness* and increased *excitement*, *relaxation*, and *satisfaction*. Additionally, the Treatment group also got benefited from increased *energy*, *eagerness to go to work*, *happiness during intense work*, and *resilience*, and decreased *feeling tired after waking up*. The other positive changes are hard to be confirmed due to the lack of significance. Overall, we find significant positive results in how the Treatment individuals showed longer-term wellbeing improvements at the end of the six-weeks study.

4.3 RQ3: Use, benefits, and challenges of scheduling focus time

Finally, for RQ3, we examine the qualitative and open-ended components of our surveys to understand how was Focus Time used during the study. In the following paragraphs, we report our findings on the use and perceived benefits and challenges of Focus Time.

What people do during Focus Time? The weekly surveys asked the participants, "Out of the booked focus time on your calendar, please check which of the following you recall using it for (select all that apply." Table 5 shows the distribution of activities that people chose; we find that participants used the feature for several purposes, with maximum responses about focused deep work, catching up on backlogged work, and email and communications. We also followed this question with "Think about the previous question. Did you plan your activity during the focus time periods?", to which the responses were *yes* (23),

Table 5. Activities and counts of self-reported responses received of using Focus Time periods.

Focused deep work	69
Personal errands	22
Exercise	21
Taking a break	41
Email and communications	61
Catching up on backlogged work	62
Other	0

somewhat (53), and *no* (15). This indicates that there are several instances that activities during Focus Time can be unplanned or unanticipated apriori.

Need of Focus Time. The exit reflection survey asked the Treatment participants about their likelihood to continue using Focus Time, to which 13 participants responded positively (5 responded *extremely likely* and 2 responded *quite likely*), and 2 responded negatively (1 responded *unlikely* and 1 responded *extremely unlikely*). We also asked the Control participants about their desire to use an automated service that could help block times on their calendars on a scale of 1 (I do not want it at all) to 5 (I would very much like to have it), where the average response is 3.4, showing a slight inclination towards the desire to such a service.

Benefits of Focus Time. We asked the Treatment participants about the benefits of having Focus Time on their calendars. A majority of the responses included participants' appreciation for self-time on calendars, and not being disrupted by others booking times for meetings. One participant expressed, "It forced me to keep a block of time open for "me". I mean that it won't let me book my whole day up and not give me time to do the things I need to do."

Another participant described the feature as a "safe haven": "It's so nice to be able to get away from constant meetings. Calendar blocks feel like a safe haven from having to listen to people ask for more and more of your time. It's also so nice to be able to work through a to-do list and actually see the amount I have left to do go down." Similarly, people reflected on minimizing distractions and being able to do focused work: "Teammates will not book meetings at that time. I know I can get time to do what I need to get done without distractions. I feel more relaxed at this time."

Challenges of Focus Time. Treatment participants responded to what are the drawbacks and challenges of using Focus Time, where we got a variety of responses. Participants were concerned about the misalignment in the actual and their necessary scheduling of time to focus. Two participants expressed that Focus Time schedule might not always coincide with their readiness to focus, such as one expressed: "I felt that the focus time came up so quickly some days that I wasn't prepared to take it at that specific time. I felt that the focus time was too short as well."

Two participants expressed the challenge that others would still be able to book meetings during their Focus Time, and two found it challenging that they had to sometimes schedule meetings during Focus Time: "The challenge of having time blocked is I was not always able to utilize the focus time due to scheduling conflicts."

Five participants expressed that they would like some transparency with specific team members so that they can schedule high-priority meetings even during focus time. A participant was not happy that they were not alerted about the meetings booked during focus time and how they "accidentally missed a meeting with their boss." Similarly, participants also expressed they would like more control over the feature and the ability to personalize what notifications they block or receive during Focus Time, such as, one participant expressed: "I like having time blocked but I disliked the computer doing it for me. I want to do it at different times for different durations vs. ceding control of my calendar."

What can be improved for Focus Time? Finally, we asked the participants if they would like specific things to be improved for Focus Time. Related to the drawbacks expressed above, a majority of the responses were about the desire for more control and the ability to select Focus Time, in terms of scheduling Focus Time at the start of every week and the ability to control the notifications from specific individuals, such as: "I wish I could grant access to a few people to book time during my focus time. But just a few people and blocked off from the others."

Multiple participants also desired for a better visual identifier for Focus Time which is different from "available" and "busy" status on internal communication platform (Teams) and email (outlook) interface: "Come up with an easily identified universal visual indication of focus time, whether that's a color, a line shape, or something like that, so that it is easily identified at a glance by all users."

5 DISCUSSION

5.1 Theoretical Implications

Our work adds to the body of literature on time management of information workers (see Related Work, Section 2). This study provides empirical insights into the effectiveness of a computing-assisted time protection service (Focus Time) in scheduling time to focus, and how that impacts the eudaimonic wellbeing and work engagement of information workers. The findings largely support prior research about the expected efficacy of digitally protecting time, including how dedicating time to oneself without being disrupted by notifications can help improve a worker's stress levels, wellbeing, and productivity [28, 72, 73]. Our findings also align with Das Swain et al.'s study that a Focus Time service can help minimize distractions due to synchronous communication at work and help information workers rearrange their work better, effectively reducing their workload and improving their wellbeing.

Our study suggests heterogeneity in characterizing "focus" in Focus Time—we received varying responses across focused deep work, personal errands, exercise, taking a break, emails, and catching up with backlogged work. It is plausible that focus time can also be used in other ways depending on the needs and desires of a worker and a specific situation. This motivates further research into understanding how self-focus time is used. Our findings reveal new insights into how the definition of "focused work" may have evolved over changing work settings—Mark et al. noted that focused work is associated with higher stress. However, our findings reveal that information workers' stress is reduced after using Focus Time. We situate this observation with how shorter focus, task switching, and multitasking can often overwhelm and cause stress [72]. It is interesting to note that even though Focus Time could be considered to be a service that supports cognitive aspects at work, we find that this can also benefit wellbeing and related emotional and social constructs.

5.2 Practical and Design Implications

This work bears practical implications in designing and building tools that programmatically help the time management of information workers. These services are even more relevant with the increasing prevalence of remote and hybrid work, as well as blurred boundaries between personal and professional lives. While our findings note that such a service can help the wellbeing and work engagement, we also found the use case, existing challenges, and potential improvements of such a service.

We found that some participants desired more control in scheduling Focus Time, and some expressed the misalignment between when they want and when the system schedules Focus Time. This motivates building tools accounting for both user control and semi-automated personalized approaches leveraging user behaviors and context (as seen in [78, 92]). Additionally, dedicating time for focus work might seem too generic, and individuals may not realize the purpose of these periods (as also observed in our study). This calls for designing and evaluating tools that are more specific with recommendations on how a user could use the time (e.g., recommending "exercise time", "email communications time").

Along the lines of the above, participants noted how they encountered the focus time on their schedule somewhat unexpectedly and unplanned. This calls for integrating the Focus Time feature with more self-reflection and self-planning opportunities; for example, individuals are sent their upcoming Focus Time schedules in advance, along with possible recommendations for better using the feature. Again, participants may have been unaware of the need or effectiveness of such a feature. Findings, such as that from our study and other research [31], on the benefits of computer-assisted protected time, can serve as scientific evidence to motivate participants about using the feature better and making the best use of it.

While this study was specifically about focus work features on work devices, there are similar features on other devices, such as smartphones that block notifications during specific times of the day (e.g., during sleep or focused work). It would be interesting to examine the effectiveness of such features on digital wellbeing and optimized time use.

5.3 Ethical and Policy Implications

Our work found the challenges individuals faced with using Focus Time. While these challenges and mitigation strategies not only provide new insights into designing Focus Time-related features but also opens up new discussions on how better transparency, awareness, and explainability about the feature could help prevent some of the concerns, borrowing from anticipatory ethics research [3, 13]. For instance, can we think of information guides that come with these tools which not only inform the users about the information and use case about the technology but also the likely "side-effects" of using the technologies, such as how these are described in medication guides that come with prescription drugs? Future research can also evaluate the effectiveness of these approaches.

This work also bears organizational and policy-facing implications, especially showing how productivity and wellbeing benefits are intertwined. Our work provides empirical insights into how dedicating time to an individual's focused work can help them improve their wellbeing. Therefore, organizations can also include dedicated, focused time work as a part of the employees' work schedules. This can be along the lines of what organizations have recently been exploring the policies of no-meeting day, no-meeting week, and flexible work-week to enhance worker wellbeing [60, 102]. Further, we observed that participants expressed challenges that others would still schedule meetings during Focus Time or they would feel the necessity to prioritize meetings over focused work during these periods. Some of these practices may not necessarily be technology-driven but rather systemic—organizations can promote culture and norms of respecting each others' focus times to facilitate a thriving environment. Together, these approaches can help workers to manage their workload better as well as be happier and more productive at work.

It would be interesting to examine if features such as Focus Time can be gamified. Employers can be worried that workers might misuse these features for "me-time" when they are on their employers' time and evade work-related responsibilities. In fact, employers can build these features to gather more transparency about what employees do during Focus Time periods. However, such tools will cause workplace surveillance and bossware-related concerns [5, 14]. In addition, recent research has critically questioned the applicability of different digital and sensing technologies in the workplace [25, 26, 30, 41, 51]. These challenges span across employee privacy concerns, misalignments in expectations and outcomes, and other bias issues. Therefore, navigating these tensions between employee privacy and employer transparency requirements remains important. This work motivates research in gathering multi-stakeholder perspectives about these technologies from organizational leaders, HR and policymakers, AI builders, and worker data subjects, and co-designing exercises of what improvements can be made with features such as Focus Time.

5.4 Limitations and Future Directions

While the findings are promising, we acknowledge that our pool is small (25), for a short duration (six weeks), and limited to U.S. information workers. Therefore, we cannot make conclusive generalizability claims. Our study is also not immune to novelty effects [56], i.e., it is possible that the participants found the feature to be exciting and used it during the course of the study. It was interesting that participants did not complain about the burden of using a service, an expected issue in the design and deployment of new HCI tools [66]. However, the long-term user burden and acceptance of the feature remains unknown [49]. Therefore, our work motivates future research in evaluating the effectiveness on a larger scale and longer duration. While it was out of scope from the current study, we also noted some

positive improvements in the Control individuals, which could be attributed to the advantages of personal journaling and self-reflections [6, 106] that these participants periodically did when responding to weekly surveys. In addition, our participants may have been subjected to observer effect [87] and our study likely suffers from self-selection biases—we only studied participants willing to use Focus Time and participate in the study. Studies through passive sensing could be a means to mitigate some of these limitations. However, such research or real-world experiments could raise ethical and privacy-related concerns [50]. This provokes discussion in designing research that balances privacy-related concerns but obtains holistic findings about the need and efficacy of such computing-assisted technologies at workplaces.

6 CONCLUSION

We examined the effectiveness of a computer-assisted protected time service, Viva Focus Time on Outlook calendars, which automatically schedules time for focused work on people's work calendars. We conducted an experimental study over six weeks with 15 Treatment individuals who were asked to use the Focus Time service and 10 Control individuals who did not use the service. The participants responded to survey questions on eudaimonic wellbeing and work engagement throughout the study. We found that the Treatment participants showed significantly higher wellbeing and work engagement both temporally over the weeks, as well as in the long-term at the end of the study compared to the beginning. In particular, the Treatment participants showed increased excitement, relaxation, and satisfaction, and decreased anger, frustration, tiredness, and stress. We also studied the needs, benefits, and challenges of scheduling focus time. While participants realized the benefits of the service, but they also sought more control in scheduling their focus time as per convenience. This study provides empirical evidence about the importance of enabling mechanisms to support focused work and bears implications for designing tools for supporting focused work.

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REFERENCES

[1] Ritu Agarwal and Elena Karahanna. 2000. Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS quarterly* (2000), 665–694.

[2] Demosthenes Akoumianakis and George Ktistakis. 2017. Digital calendars for flexible organizational routines. *Journal of Enterprise Information Management* 30, 3 (2017), 476–502.

[3] Matthew Arnold, Rachel KE Bellamy, Michael Hind, Stephanie Houde, Sameep Mehta, Aleksandra Mojsilović, Ravi Nair, K Natesan Ramamurthy, Alexandra Olteanu, David Piorkowski, et al. 2019. FactSheets: Increasing trust in AI services through supplier's declarations of conformity. *IBM Journal of Research and Development* 63, 4/5 (2019), 6–1.

[4] Brian P Bailey, Joseph A Konstan, and John V Carlis. 2001. The Effects of Interruptions on Task Performance, Annoyance, and Anxiety in the User Interface.. In *Interact*, Vol. 1. 593–601.

[5] Kirstie Ball. 2021. Electronic Monitoring and Surveillance in the Workplace. *Publications Office of the European Union, Luxembourg, doi* 10 (2021), 5137.

[6] Eric PS Baumer, Vera Khovanskaya, Mark Matthews, Lindsay Reynolds, Victoria Schwanda Sosik, and Geri Gay. 2014. Reviewing reflection: on the use of reflection in interactive system design. In *Proceedings of the 2014 conference on Designing interactive systems*. 93–102.

[7] Piotr Bialowolski, Eileen McNeely, Tyler J VanderWeele, and Dorota Weziak-Bialowolska. 2020. Ill health and distraction at work: Costs and drivers for productivity loss. *Plos one* 15, 3 (2020), e0230562.

[8] Gianluca Biggio and ClaudioG Cortese. 2013. Well-being in the workplace through interaction between individual characteristics and organizational context. *International journal of qualitative studies on health and well-being* 8, 1 (2013), 19823.

[9] Douglas W Billings, Royer F Cook, April Hendrickson, and David C Dove. 2008. A web-based approach to managing stress and mood disorders in the workforce. *Journal of occupational and environmental medicine/American College of Occupational and Environmental Medicine* 50, 8 (2008), 960.

[10] Mehrab Bin Morshed, Javier Hernandez, Daniel McDuff, Jina Suh, Esther Howe, et al. 2022. Advancing the Understanding and Measurement of Workplace Stress in Remote Information Workers from Passive Sensors and Behavioral Data. In *2022 10th International Conference on Affective Computing and Intelligent Interaction (ACII)*. IEEE.

[11] Mehrab Bin Morshed, Koustuv Saha, Richard Li, Sidney K. D'Mello, Munmun De Choudhury, Gregory D. Abowd, and Thomas Plötz. 2019. Prediction of Mood Instability with Passive Sensing. *PACM IMWUT* (2019).

[12] Anna Bleakley, Daniel Rough, Justin Edwards, Philip Doyle, Odile Dumbleton, Leigh Clark, Sean Rintel, Vincent Wade, and Benjamin R Cowan. 2022. Bridging social distance during social distancing: exploring social talk and remote collegiality in video conferencing. *Human–Computer Interaction* 37, 5 (2022), 404–432.

[13] Margarita Boyarskaya, Alexandra Olteanu, and Kate Crawford. 2020. Overcoming failures of imagination in AI infused system development and deployment. *arXiv preprint arXiv:2011.13416* (2020).

[14] danah boyd and Kate Crawford. 2012. Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon. *Information, communication & society* 15, 5 (2012), 662–679.

[15] Chloë Brown, Christos Efstratiou, Ilias Leontiadis, Daniele Quercia, Cecilia Mascolo, James Scott, and Peter Key. 2014. The architecture of innovation: Tracking face-to-face interactions with ubicomp technologies. In *Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing*. ACM, 811–822.

[16] Steven P Brown. 1996. A meta-analysis and review of organizational research on job involvement. *Psychological bulletin* 120, 2 (1996), 235.

[17] Alex Bryson, John Forth, and Lucy Stokes. 2014. Does worker wellbeing affect workplace performance. *Department for Business Innovation & Skills* (2014).

[18] Michael J Brzozowski. 2009. WaterCooler: exploring an organization through enterprise social media. In *Proceedings of the ACM 2009 international conference on Supporting group work*. ACM, 219–228.

[19] Aldijana Bunjak, Matej Černe, and Aleš Popovič. 2021. Absorbed in technology but digitally overloaded: Interplay effects on gig workers' burnout and creativity. *Information & Management* 58, 8 (2021), 103533.

[20] Scott A Cambo, Daniel Avrahami, and Matthew L Lee. 2017. BreakSense: Combining physiological and location sensing to promote mobility during work-breaks. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. 3595–3607.

[21] Hancheng Cao, Chia-Jung Lee, Shamsi Iqbal, Mary Czerwinski, Priscilla NY Wong, Sean Rintel, Brent Hecht, Jaime Teevan, and Longqi Yang. 2021. Large scale analysis of multitasking behavior during remote meetings. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–13.

[22] Francesco Cirillo. 2018. *The Pomodoro technique: The life-changing time-management system*. Random House.

[23] Brigitte JC Claessens, Wendelien Van Eerde, Christel G Rutte, and Robert A Roe. 2007. A review of the time management literature. *Personnel review* (2007).

[24] Thomas W Colligan and Eileen M Higgins. 2006. Workplace stress: Etiology and consequences. *Journal of workplace behavioral health* (2006).

[25] Marios Constantinides and Daniele Quercia. 2022. Good Intentions, Bad Inventions: How Employees Judge Pervasive Technologies in the Workplace. *IEEE Pervasive Computing* (2022).

[26] Shanley Corvite, Kat Roemmich, Tillie Rosenberg, and Nazanin Andalibi. 2022. Data Subjects' Perspectives on Emotion Artificial Intelligence Use in the Workplace: A Relational Ethics Lens. *Proceedings of the ACM on Human-Computer Interaction* (2022).

[27] National Research Council. 1994. *Organizational Linkages: Understanding the Productivity Paradox*. The National Academies Press, Washington, DC. https://doi.org/10.17226/2135

[28] Mary Czerwinski, Eric Horvitz, and Susan Wilhite. 2004. A diary study of task switching and interruptions. In *Proceedings of the SIGCHI conference on Human factors in computing systems*. 175–182.

[29] Vedant Das Swain et al. 2019. A Multisensor Person-Centered Approach to Understand the Role of Daily Activities in Job Performance with Organizational Personas. *PACM IMWUT* (2019).

[30] Vedant Das Swain, Lan Gao, William A Wood, Srikruthi C Matli, Gregory D Abowd, and Munmun De Choudhury. 2023. Algorithmic Power or Punishment: Information Worker Perspectives on Passive Sensing Enabled AI Phenotyping of Performance and Wellbeing. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. 1–17.

[31] Vedant Das Swain, Javier Hernandez, Brian Houck, Koustuv Saha, Jina Suh, Ahad Chaudhry, Tenny Cho, Wendy Guo, Shamsi T Iqbal, and Mary Czerwinski. 2023. Focused Time Saves Nine: Evaluating Computer-Assisted Protected Time for Hybrid Information Work. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (2023).

[32] Vedant Das Swain, Manikanta D. Reddy, Kari Anne Nies, Louis Tay, Munmun De Choudhury, and Gregory D. Abowd. 2019. Birds of a Feather Clock Together: A Study of Person–Organization Fit Through Latent Activity Routines. *Proc. ACM Hum.-Comput. Interact* CSCW (2019).

[33] Vedant Das Swain, Koustuv Saha, Gregory D Abowd, and Munmun De Choudhury. 2020. Social media and ubiquitous technologies for remote worker wellbeing and productivity in a post-pandemic world. In *2020 IEEE Second International Conference on Cognitive Machine Intelligence (CogMI)*. IEEE, 121–130.

[34] Vedant Das Swain, Koustuv Saha, Manikanta D Reddy, Hemang Rajvanshy, Gregory D Abowd, and Munmun De Choudhury. 2020. Modeling Organizational Culture with Workplace Experiences Shared on Glassdoor. In *CHI*.

[35] Munmun De Choudhury and Scott Counts. 2013. Understanding affect in the workplace via social media. In *Proceedings of the 2013 conference on Computer supported cooperative work*. ACM, 303–316.

[36] Jan-Emmanuel De Neve, Ed Diener, Louis Tay, and Cody Xuereb. 2013. The objective benefits of subjective well-being. *World happiness report* (2013).

[37] Edeltraud Egger and Ina Wagner. 1992. Time-Management: A Case for CSCW. In *Proceedings of the 1992 ACM Conference on Computer-Supported Cooperative Work* (Toronto, Ontario, Canada) *(CSCW '92)*. Association for Computing Machinery, New York, NY, USA, 249–256. https://doi.org/10.1145/143457.143517

[38] Daniel A Epstein, Daniel Avrahami, and Jacob T Biehl. 2016. Taking 5: Work-breaks, productivity, and opportunities for personal informatics for knowledge workers. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. 673–684.

[39] Benjamin Franklin. 1909. *The Autobiography of Benjamin Franklin*. Vol. 1. Createspace Independent Publishing Platform.

[40] Eric Gilbert. 2012. Phrases that signal workplace hierarchy. In *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work*. ACM, 1037–1046.

[41] Sandy JJ Gould, Anna Rudnicka, Dave Cook, Marta E Cecchinato, Joseph W Newbold, and Anna L Cox. 2023. Remote work, work measurement, and the state of work research in human-centred computing. *Interacting with Computers* (2023).

[42] Paul Green. 2016. The perceived influence on organizational productivity: a perspective of a public entity. *Problems & perspectives in management (Print)* (2016).

[43] Ted Grover, Kael Rowan, Jina Suh, Daniel McDuff, and Mary Czerwinski. 2020. Design and evaluation of intelligent agent prototypes for assistance with focus and productivity at work. In *Proceedings of the 25th International Conference on Intelligent User Interfaces*. 390–400.

[44] Andreas Größler and Alexander Zock. 2010. Supporting long-term workforce planning with a dynamic aging chain model: A case study from the service industry. *Human Resource Management* 49 (09 2010), 829 – 848. https://doi.org/10.1002/hrm.20382

[45] Edward Cutrell Mary Czerwinski Eric Horvitz. 2001. Notification, disruption, and memory: Effects of messaging interruptions on memory and performance. In *Human-Computer Interaction: INTERACT*, Vol. 1. 263.

[46] Esther Howe, Jina Suh, Mehrab Bin Morshed, Daniel McDuff, Kael Rowan, Javier Hernandez, Marah Ihab Abdin, Gonzalo Ramos, Tracy Tran, and Mary P Czerwinski. 2022. Design of Digital Workplace Stress-Reduction Intervention Systems: Effects of Intervention Type and Timing. In *CHI Conference on Human Factors in Computing Systems*. 1–16.

[47] Shamsi T Iqbal and Eric Horvitz. 2007. Disruption and recovery of computing tasks: field study, analysis, and directions. In *Proceedings of the SIGCHI conference on Human factors in computing systems*. 677–686.

[48] Shamsi T Iqbal and Eric Horvitz. 2010. Notifications and awareness: a field study of alert usage and preferences. In *Proceedings of the 2010 ACM conference on Computer supported cooperative work*. 27–30.

[49] Bahar Irfan, Aditi Ramachandran, Samuel Spaulding, Dylan F Glas, Iolanda Leite, and Kheng Lee Koay. 2019. Personalization in long-term human-robot interaction. In *2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*. IEEE, 685–686.

[50] Jukka Jouhki, Epp Lauk, Maija Penttinen, Niina Sormanen, and Turo Uskali. 2016. Facebook's emotional contagion experiment as a challenge to research ethics. *Media and Communication* 4 (2016).

[51] Anna Kawakami, Shreya Chowdhary, Shamsi T Iqbal, Q Vera Liao, Alexandra Olteanu, Jina Suh, and Koustuv Saha. 2023. Sensing Wellbeing in the Workplace, Why and For Whom? Envisioning Impacts with Organizational Stakeholders. *Proceedings of the ACM on Human-Computer Interaction (CSCW)* (2023).

[52] Jaejeung Kim, Chiwoo Cho, and Uichin Lee. 2017. Technology supported behavior restriction for mitigating self-interruptions in multi-device environments. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 1, 3 (2017), 1–21.

[53] Jaejeung Kim, Hayoung Jung, Minsam Ko, and Uichin Lee. 2019. GoalKeeper: exploring interaction lockout mechanisms for regulating smartphone use. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 3, 1 (2019), 1–29.

[54] Everlyne Kimani, Kael Rowan, Daniel McDuff, Mary Czerwinski, and Gloria Mark. 2019. A conversational agent in support of productivity and wellbeing at work. In *2019 8th international conference on affective computing and intelligent interaction (ACII)*. IEEE, 1–7.

[55] Dee K Knight, Christy Crutsinger, and HaeJung Kim. 2006. The impact of retail work experience, career expectation, and job satisfaction on retail career intention. *Clothing and Textiles Research Journal* 24, 1 (2006), 1–14.

[56] Michael Koch, Kai von Luck, Jan Schwarzer, and Susanne Draheim. 2018. The novelty effect in large display deployments–Experiences and lessons-learned for evaluating prototypes. In *Proceedings of 16th European conference on computer-supported cooperative work-exploratory papers*. European Society for Socially Embedded Technologies (EUSSET).

[57] Seyma Kucukozer-Cavdar, Tugba Taskaya-Temizel, Abhinav Mehrotra, Mirco Musolesi, and Peter Tino. 2021. Designing Robust Models for Behaviour Prediction Using Sparse Data from Mobile Sensing: A Case Study of Office Workers' Availability for Well-being Interventions. *ACM Transactions on Computing for Healthcare* 2, 4 (2021), 1–33.

[58] Andrew Kun, Orit Shaer, and Shamsi Iqbal. 2021. The Future of Work: COVID-19 and Beyond. *IEEE Pervasive Computing* 20, 04 (2021), 7–8.

[59] Kostadin Kushlev and Elizabeth W Dunn. 2015. Checking email less frequently reduces stress. *Computers in Human Behavior* 43 (2015), 220–228.

[60] Ben Laker, Vijay Pereira, Pawan Budhwar, and Ashish Malik. 2022. The surprising impact of meeting-free days. *MIT Sloan Management Review* (2022).

[61] Jongseo Lee and Juyoung Kang. 2017. A Study on Job Satisfaction Factors in Retention and Turnover Groups using Dominance Analysis and LDA Topic Modeling with Employee Reviews on Glassdoor. com. (2017).

[62] Pierre-Majorique Léger, Fred D Davis, Timothy Paul Cronan, and Julien Perret. 2014. Neurophysiological correlates of cognitive absorption in an enactive training context. *Computers in Human Behavior* 34 (2014), 273–283.

[63] P Litchfield. 2021. Workplace wellbeing. *Perspectives in Public Health* 141, 1 (2021), 11–12.

[64] Edwin A Locke and Gary P Latham. 1990. *A theory of goal setting & task performance.* Prentice-Hall, Inc.

[65] Kevin P Madore, Anna M Khazenzon, Cameron W Backes, Jiefeng Jiang, Melina R Uncapher, Anthony M Norcia, and Anthony D Wagner. 2020. Memory failure predicted by attention lapsing and media multitasking. *Nature* 587, 7832 (2020), 87–91.

[66] Nikola Marangunić and Andrina Granić. 2015. Technology acceptance model: a literature review from 1986 to 2013. *Universal access in the information society* 14, 1 (2015), 81–95.

[67] Gloria Mark, Victor M Gonzalez, and Justin Harris. 2005. No task left behind? Examining the nature of fragmented work. In *Proceedings of the SIGCHI conference on Human factors in computing systems*. 321–330.

[68] Gloria Mark, Daniela Gudith, and Ulrich Klocke. 2008. The cost of interrupted work: more speed and stress. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems*. 107–110.

[69] Gloria Mark, Shamsi Iqbal, and Mary Czerwinski. 2017. How blocking distractions affects workplace focus and productivity. In *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers*. 928–934.

[70] Gloria Mark, Shamsi Iqbal, Mary Czerwinski, and Paul Johns. 2014. Capturing the mood: facebook and face-to-face encounters in the workplace. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing*. ACM, 1082–1094.

[71] 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*. ACM, 3025–3034.

[72] Gloria Mark, Shamsi T Iqbal, Mary Czerwinski, Paul Johns, and Akane Sano. 2016. Neurotics can't focus: An in situ study of online multitasking in the workplace. In *Proceedings of the 2016 CHI conference on human factors in computing systems*. 1739–1744.

[73] Gloria Mark, Shamsi T Iqbal, Mary Czerwinski, Paul Johns, Akane Sano, and Yuliya Lutchyn. 2016. Email duration, batching and self-interruption: Patterns of email use on productivity and stress. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. ACM, 1717–1728.

[74] Gloria Mark, Stephen Voida, and Armand Cardello. 2012. A pace not dictated by electrons: an empirical study of work without email. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 555–564.

[75] Gloria Mark, Yiran Wang, and Melissa Niiya. 2014. Stress and multitasking in everyday college life: an empirical study of online activity. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 41–50.

[76] Aleksandar Matic, Venet Osmani, and Oscar Mayora-Ibarra. 2014. Mobile monitoring of formal and informal social interactions at workplace. In *ACM International Joint Conference on Pervasive and Ubiquitous Computing*.

[77] Stephen M Mattingly et al. 2019. The Tesserae Project: Large-Scale, Longitudinal, In Situ, Multimodal Sensing of Information Workers. In *CHI Ext. Abstracts*.

[78] Abhinav Mehrotra, Fani Tsapeli, Robert Hendley, and Mirco Musolesi. 2017. MyTraces: Investigating correlation and causation between users' emotional states and mobile phone interaction. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 1, 3 (2017), 1–21.

[79] Sarah Mennicken, David Kim, and Elaine May Huang. 2016. Integrating the smart home into the digital calendar. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. 5958–5969.

[80] Microsoft. 2021. The Rise of the Triple Peak Day. *https://www.microsoft.com/en-us/worklab/triple-peak-day* (2021).

[81] Microsoft. 2023. Focus plan, Microsoft Viva Insights. https://learn.microsoft.com/en-us/viva/insights/personal/use/focus-plan. Accessed: 2023-01-19.

[82] Shayan Mirjafari, Kizito Masaba, Ted Grover, Weichen Wang, Pino Audia, Andrew T. Campbell, Nitesh V. Chawla, Vedant Das Swain, Munmun De Choudhury, Anind K. Dey, and et al. 2019. Differentiating Higher and Lower Job Performers in the Workplace Using Mobile Sensing. *Proc. ACM IMWUT* (2019).

[83] Tanushree Mitra and Eric Gilbert. 2012. Have you heard?: How gossip flows through workplace email. In *ICWSM*.

[84] Tanushree Mitra, Michael Muller, N Sadat Shami, Abbas Golestani, and Mikhil Masli. 2017. Spread of Employee Engagement in a Large Organizational Network: A Longitudinal Analysis. *Proceedings of the ACM on Human-Computer Interaction* 1, CSCW (2017), 81.

[85] Peter Oeij, Michiel Looze, Klaas ten Have, J.W. Rhijn, and Lottie Kuijt-Evers. 2012. Developing the organization's productivity strategy in various sectors of industry. *International Journal of Productivity and Performance Management* 61 (01 2012), 93–109. https://doi.org/10.1108/17410401211187525

[86] Fabian Okeke, Michael Sobolev, Nicola Dell, and Deborah Estrin. 2018. Good vibrations: can a digital nudge reduce digital overload?. In *Proceedings of the 20th international conference on human-computer interaction with mobile devices and services*. 1–12.

[87] David Oswald, Fred Sherratt, and Simon Smith. 2014. Handling the Hawthorne effect: The challenges surrounding a participant observer. *Review of social studies* 1, 1 (2014), 53–73.

[88] Iris Reychav and Dezhi Wu. 2015. Are your users actively involved? A cognitive absorption perspective in mobile training. *Computers in Human Behavior* 44 (2015), 335–346.

[89] Daniel Russell, Carman Neustaedter, John Tang, Tejinder Judge, and Gary Olson. 2021. Videoconferencing in the Age of COVID: How Well Has It Worked Out?. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–2.

[90] Daniel Russo, Paul HP Hanel, Seraphina Altnickel, and Niels van Berkel. 2021. Predictors of well-being and productivity among software professionals during the COVID-19 pandemic–a longitudinal study. *Empirical Software Engineering* 26, 4 (2021), 1–63.

[91] Koustuv Saha et al. 2019. Social Media as a Passive Sensor in Longitudinal Studies of Human Behavior and Wellbeing. In *CHI Ext. Abstracts*. ACM.

[92] Koustuv Saha, Yozen Liu, Nicholas Vincent, Farhan Asif Chowdhury, Leonardo Neves, Neil Shah, and Maarten W Bos. 2021. AdverTiming Matters: Examining User Ad Consumption for Effective Ad Allocations on Social Media. In *Proc. CHI*.

[93] Koustuv Saha, Manikanta D Reddy, Stephen Mattingly, Edward Moskal, Anusha Sirigiri, and Munmun De Choudhury. 2019. Libra: On linkedin based role ambiguity and its relationship with wellbeing and job performance. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–30.

[94] Koustuv Saha, Asra Yousuf, Louis Hickman, Pranshu Gupta, Louis Tay, and Munmun De Choudhury. 2021. A Social Media Study on Demographic Differences in Perceived Job Satisfaction. *Proceedings of the ACM on Human-Computer Ineraction (CSCW)* (2021).

[95] Advait Sarkar, Sean Rintel, Damian Borowiec, Rachel Bergmann, Sharon Gillett, Danielle Bragg, Nancy Baym, and Abigail Sellen. 2021. The promise and peril of parallel chat in video meetings for work. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–8.

[96] Wilmar B Schaufeli, Arnold B Bakker, and Marisa Salanova. 2003. Utrecht work engagement scale-9. *Educational and Psychological Measurement* (2003).

[97] Florian Schaule, Jan Ole Johanssen, Bernd Bruegge, and Vivian Loftness. 2018. Employing consumer wearables to detect office workers' cognitive load for interruption management. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 2, 1 (2018), 1–20.

[98] Klaus Schwab. 2017. *The fourth industrial revolution*. Currency.

[99] Anna Sell. 2008. Mobile digital calendars in knowledge work. *International Journal of Mobile Communications* 6, 6 (2008), 696–713.

[100] N Sadat Shami, Michael Muller, Aditya Pal, Mikhil Masli, and Werner Geyer. 2015. Inferring employee engagement from social media. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*.

[101] N Sadat Shami, Jeffrey Nichols, and Jilin Chen. 2014. Social media participation and performance at work: a longitudinal study. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 115–118.

[102] David A Shore. 2013. Fewer. Shorter. Better: Effective and efficient meetings for higher performing organizations. *Journal of health communication* 18, 11 (2013), 1275–1278.

[103] Danijela Sokolic. 2022. Remote work and hybrid work organizations. *Economic and social development: Book of proceedings* (2022), 202–213.

[104] Michael F Steger, Bryan J Dik, and Ryan D Duffy. 2012. Measuring meaningful work: The work and meaning inventory (WAMI). *Journal of career Assessment* 20, 3 (2012), 322–337.

[105] Shaun Subel, Martin Stepanek, and Thomas Roulet. 2022. How shifts in remote behavior affect employee well-being. *MIT Sloan Management Review* 63, 3 (2022), 1–6.

[106] Alice Thudt, Uta Hinrichs, Samuel Huron, and Sheelagh Carpendale. 2018. Self-reflection and personal physicalization construction. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–13.

[107] Vincent W-S Tseng, Matthew L Lee, Laurent Denoue, and Daniel Avrahami. 2019. Overcoming distractions during transitions from break to work using a conversational website-blocking system. In *Proceedings of the 2019 CHI conference on human factors in computing systems*. 1–13.

[108] Paul T Van Katwyk, Suzy Fox, Paul E Spector, and E Kevin Kelloway. 2000. Using the Job-Related Affective Well-Being Scale (JAWS) to investigate affective responses to work stressors. *Journal of occupational health psychology* 5, 2 (2000), 219.

[109] Rui Wang, Fanglin Chen, Zhenyu Chen, Tianxing Li, Gabriella Harari, Stefanie Tignor, Xia Zhou, Dror Ben-Zeev, and Andrew T Campbell. 2014. StudentLife: assessing mental health, academic performance and behavioral trends of college students using smartphones. In *Proceedings of the 2014 ACM international joint conference on pervasive and ubiquitous computing*. 3–14.

[110] Weichen Wang, Gabriella M Harari, Rui Wang, Sandrine R Müller, Shayan Mirjafari, Kizito Masaba, and Andrew T Campbell. 2018. Sensing Behavioral Change over Time: Using Within-Person Variability Features from Mobile Sensing to Predict Personality Traits. *PACM IMWUT* (2018).

[111] Xiaofeng Wang, Federico Gobbo, and Michael Lane. 2010. Turning time from enemy into an ally using the pomodoro technique. In *Agility Across Time and Space*. Springer, 149–166.

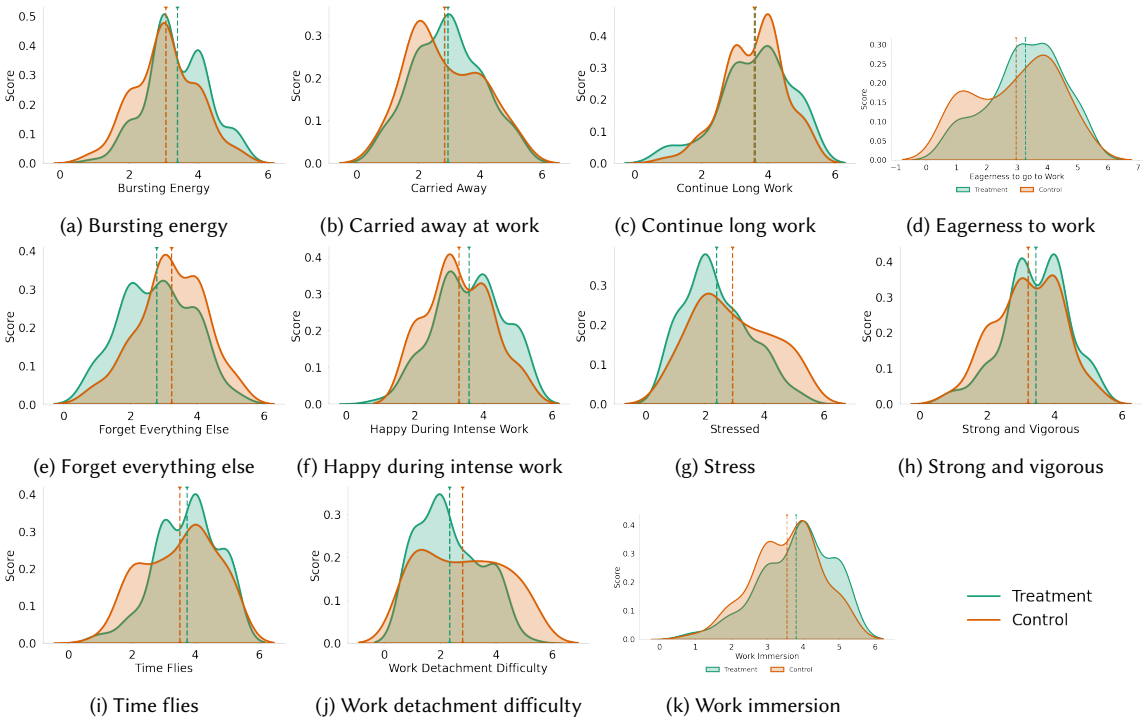
[112] Michael Winnick. 2012. dscout. In *Ethnographic Praxis in Industry Conference Proceedings*, Vol. 2012. Wiley Online Library, 378–378.

[113] Anbang Xu, Haibin Liu, Liang Gou, Rama Akkiraju, Jalal Mahmud, Vibha Sinha, Yuheng Hu, and Mu Qiao. 2016. Predicting perceived brand personality with social media. In *ICWSM*.

[114] Chi-Lan Yang, Naomi Yamashita, Hideaki Kuzuoka, Hao-Chuan Wang, and Eureka Foong. 2022. Distance Matters to Weak Ties: Exploring How Workers Perceive Their Strongly-and Weakly-Connected Collaborators in Remote Workplaces. *Proceedings of the ACM on Human-Computer Interaction* 6, GROUP (2022), 1–26.

[115] Longqi Yang, David Holtz, Sonia Jaffe, Siddharth Suri, Shilpi Sinha, Jeffrey Weston, Connor Joyce, Neha Shah, Kevin Sherman, Brent Hecht, et al. 2022. The effects of remote work on collaboration among information workers. *Nature human behaviour* 6, 1 (2022), 43–54.

7 APPENDIX



(a) Bursting energy (b) Carried away at work (c) Continue long work (d) Eagerness to work

(e) Forget everything else (f) Happy during intense work (g) Stress (h) Strong and vigorous

(i) Time flies (j) Work detachment difficulty (k) Work immersion

Fig. A1. Comparison of Treatment and Control individuals' distribution of responses. Dotted lines represent the mean of the distribution of respective color.