Focused on the task: feedback on interruption durations discourages distractions

# Abstract

Data entry often involves looking up certain information and entering this into a data entry system. Switching away from the data entry interface can be disruptive: it slows people down and can increase errors. Moreover, depending on where the information has to be retrieved from, people can get distracted and forget to return to the task. In this paper, we report two studies to investigate whether giving people feedback on how long they are away for has any effect on the duration and number of their switches. An online study was conducted in which participants had to enter numeric codes for a data entry task into an online spreadsheet. They had to look up these codes in an email that was sent to their personal email upon starting the experiment. We found that people who were shown how long they were away for made shorter switches, were faster to complete the task and made fewer data entry errors. To understand whether time feedback could help people in managing self-interruptions at the office, we then conducted a two-week field study where participants were asked to use a browser extension during data entry work which prompted a notification showing the duration of their interruptions. Qualitative results from interviews confirmed that time feedback made participants decrease the number and length of their self-interruptions. We conclude that giving people feedback on the time of their switches may make people more aware of their switching behaviour, and can assist users to focus on a task.

# Introduction

Study 1 was able to measure a significant effect on an experimental task, and participants in Study 2 gave qualitative explanations how they adapted their behaviour.

# STUDY 1

## Discussion

The aim of this study was to see whether showing people how long they switch on average reduces the number and length of their switches. The results show that people can benefit from receiving feedback on the length of their switches: participants made shorter switches, were faster to complete the task, and made fewer errors. These findings suggest that shorter switches can lead to better task performance, and are in line with previous studies connecting the duration of an interruption to its disruptiveness (Altmann, Trafton, & Hambrick, 2017; Monk, Trafton, & Boehm-Davis, 2008).

Nevertheless, as even short interruptions can have a negative effect on performance (Altmann, Trafton, & Hambrick, 2014), we were also curious as to whether the number of switches could be reduced. Interestingly, feedback on switching duration did not reduce the number of switches as in prior work (Gould, Cox, & Brumby, 2016). This could be explained by the moment in the task that people received feedback. In Gould et al.’s study, feedback appeared after *every* *switch.* Participants may have tried to reduce switches, either because they were more aware of every switch or because they wanted to avoid the message. In contrast to our study, their participants were not supposed to switch, so the number of switches was lower. In our study participants were switching more often as they had to as part of the task: on average, they switched once for every data entry (i.e., ten times per trial). Giving notifications at every switch would have had the risk of overexposing participants to notifications and limiting its usefulness (Cutrell, Czerwinski, & Horvitz, 2001; Whittaker, Hollis, & Guydish, 2016). Therefore, feedback was only given after *every trial*. Future data entry studies that require fewer switches are needed to see if a notification upon every switch can reduce both the number and length of switches. Moreover, because the notification only showed information regarding the duration of switches, participants may have focused on reducing the duration, rather than number of switches.

The current study used focus and blur events to analyse switching behaviour. This meant that task switches outside the device, with the task window still in focus, were not captured. Possibly participants learnt to not interrupt themselves when they were away from this window, but after they had returned to the window. Without an accurate estimate of how long participants should take to complete the task, it is difficult to determine moments at which participants were away from their computer (Rzeszotarski, Chi, Paritosh, & Dai, 2013). Using other techniques, such as prompts at random intervals to confirm people are still working on the task, may be able to give a further insight whether our intervention changes overall self-interruption behaviour.

Most studies on self-interruptions introduced an artificial distraction, such as chat messages, to measure when, how long, and how often people self-interrupt to attend to this distracting task (Katidioti & Taatgen, 2013; Salvucci & Bogunovich, 2010). The current study makes a small methodological contribution by using participants’ own personal email inbox, based on the assumption that email provides a source of distraction (Hanrahan & Pérez-Qu, 2015; Mark, Iqbal, Czerwinski, Johns, & Sano, 2016). However, in our study, participants only needed to find and open an email once. Once they had this email opened, they did not have to re-find it in their inbox for the remainder of the experiment, and may have had this email maximised on their screen, hiding incoming messages. In practice however, people have to first find the email in their inbox, which can partly contribute to the distraction. Our study has already shown an effect on behaviour by switching to an email inbox. We expect there to be a higher potential for distraction if people have to also find the correct email in their inbox.

The results of our experiment indicate that showing people how long they switch on average reduces the duration of switches and can improve people’s task performance. The work makes a contribution to our understanding of switching behaviour for routine data entry tasks to distracting, but task-relevant, applications such as email. Our results also suggest ways in which tendencies to attend to distractions might be mitigated, and can provide a useful pointer for the design of productivity interventions to improve focus. In the current study, an experimental task was used in order to measure task performance. We plan on running a follow-up study with participants doing their own data entry work, to evaluate whether the positive effect of time feedback on people’s switching behaviour can extend to naturalistic tasks.

# STUDY 2

## Introduction

The findings of Study 1 indicated that showing participants how long they go away for on average reduced the duration of interruptions, and made people more accurate and faster in completing a routine data entry task. However, the study used an experimental and artificial task. The focus of the study was on measuring the effect of time feedback on interruption durations and task performance, but it did not look at people’s experience in using the tool. Study 2 therefore aimed to investigate the applicability and use of the notification for people’s own data entry work. Nine office workers were asked to install and use a browser extension which, through a notification, showed how long on average they switch away from a specific task. After two weeks, they were interviewed on their experience in using the tool. The interviews aimed to explore if and how the extension could help people in managing interruptions, and being more focused on their work.

## Method

### Participants

Nine participants (six female) took part in the study. They were office workers at finance administration offices at a public university, and were invited to participate via emails sent to departmental mailing lists and via participants who had already taken part in the study. Participants worked in an open plan office, and seven participants occasionally worked from home. Participants’ work included administrative and supportive tasks, such as processing payments, and responding to queries by university staff and students. The majority of participants’ work was carried out in a web browser, and revolved around a number of web-based data entry systems. None of the participants had used a time or task management tool before. Participants were reimbursed with a £20 Amazon voucher after completing the study.

### Materials

The notification was implemented as a Google Chrome extension, using HTML, JavaScript and CSS. After installing the extension, an icon was permanently visible in participants’ browser (see Figure ). To use the extension, participants had to navigate to a web page in their web browser that they wanted to focus on, and click on the icon of the extension. Upon clicking on the icon, a pop-up appeared saying that the current web page was now ‘the main task page’, which indicated the start of a task session. Every time participants switched away during the session from this web page to another computer window, such as a different browser window, a document or an application, they received a notification indicating how long on average they go away for when switching away from the main task page. If participants switched away from a page for the first time, the notification showed a message that no switching data was available yet. To calculate the average switching duration, the extension recorded the number and duration of switches away from the main task page for the whole session. Participants ended a session by closing the page. Due to security restrictions of browser extensions, the extension was unable to save any session data after a session had ended.

The presentation of the notification was similar to Study 1 but differed in one important aspect. Whereas the notification in Study 1 appeared once after every trial, in Study 2 it appeared upon every switch away from the task. We assumed participants switched less frequently for their main work compared with the experimental task, and therefore a notification at every switch was not considered to be too disruptive.

To get an understanding of people’s interruption and window switching behaviour, participants were also asked to install ManicTime, a computer logging software which records and stores the time spent in application windows. Five participants were unable to install ManicTime on their work computer, and only used the extension. A summary of ManicTime data of the remaining four participants (P3, P4, P5 and P9) is included in this paper and used to complement the qualitative interview data.

### Procedure

Participants who expressed interest to take part in the study were sent an information sheet describing the full study details and consent form to read and sign. After signing the consent form, they were sent instructions to download and install the extension and ManicTime, and an interview was scheduled after two weeks of using the tools. Participants were free to choose when and how often to use the extension, but were instructed to use it at least once a week during a data entry task. Participants had the option to pause or stop ManicTime from running if they did not wish their computer activity to be recorded at any time, but were asked to have it running at least once a week during a data entry task.

After two weeks of using the tool, participants were interviewed at either the participant’s or the interviewer’s office. The semi-structured interviews were structured around the following themes: how participants currently manage interruptions, tasks, time and information, the context of using the extension, the usefulness of the information provided by the extension and ManicTime, and whether they made any changes on how they managed their work. Participants who did not install ManicTime were presented with screenshots during the interview, and discussed the usefulness of this type of information compared to the time information of the extension. Participants were asked to share their ManicTime data for further analysis. They were offered guidance and assistance on deleting or adapting any sensitive or confidential information in their data, such as application and website names. An interview lasted about 60 minutes and was audio recorded.

# findings and discussion

Interviews were transcribed verbatim, and a thematic analysis was used to analyse the interviews. We found that participants gained some insights to change their behaviour based on the information they received from the extension. We first briefly describe people’s switching behaviour as shown by the ManicTime data. We then discuss the usefulness of time feedback to manage interruptions around the following themes: awareness and change of behaviour, the type of interruptions, the effort to record and use data, setting goals, and the work environment.

## Switching behaviour

Table 1 summarises the average number and duration of focus on a computer window screen for the four participants of which we were able to gather ManicTime data. The mean duration of focus is about 34 seconds, with the longest focus being 48 minutes (2893 seconds). Participants’ working hours differed slightly, but all participants worked at least ten hours per day during the study. To make the data comparable between participants, we only considered data between 9am and 7pm, during which all participants were at work. On average, participants made 830 computer window switches per working day. The distribution of window focus durations is plotted in Figure 1, illustrating that participants were rarely focused on a window for more than a minute. Together with the interview findings, the data shows that participants’ work was characterised by short durations of focus and frequent window switches. Figures 2 and 3 show the average number of daily window switches and focus durations over the ten days of the study.

In addition to computer window switches, participants also made a smaller number of non-digital interruptions, for example when taking a break or attending a meeting (see Table 1). On average participants made three daily non-digital interruptions which lasted about 29 minutes (1741 seconds).

Table 1. Average window focus durations (s) and number of daily switches.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean (SD) | Median | Min | Max |
| Window focus duration (s) | 33.88 (80.74) | 11.00 | 1.00 | 2893 |
| Daily switches between windows | 829.5 (422.85) | 843 | 9 | 1741 |
| Non-digital interruption durations (s) | 1741.09 (1886.17) | 992.5 | 47.00 | 10457 |
| Daily non-digital interruptions | 2.74 (1.96) | 2 | 1 | 7 |



Figure 1. Distribution of 97% of window focus durations; the total distribution goes up to 2893 seconds (48 minutes).



Figure 2. Window focus durations during the study.



Figure 3. Number of daily window switches during the study.

## Awareness and changing behaviour

Participants were largely aware they interrupted their work frequently and considered it the nature of their job: they regularly had to stop their work to look up task-related information, and had to address ad-hoc queries and requests from their department. Some interruptions were hard to avoid because they were urgent, important, or necessary to progress with work. The extension however made participants realise they were unaware these interruptions were much longer than they considered necessary. The notification was a trigger to then reflect on the reasons for this:

“It's a shock, because I knew it was bad, I didn't think it was that bad. (…) So it's reflecting on, actually, a two-minute task is turning into a 15-20 minute task - why is that? (…) Why? But again, it's distractions.” (P9)

If they realised upon reflection that they were distracted by irrelevant activities during these interruptions, participants tried to avoid these activities and focus on the goal of the interruption, for example by setting an explicit time limit for themselves:

“It would give me a chance to maybe cut out some stuff that I felt wasn’t really relevant. (…) I spent an hour yesterday on Google, what was I doing? It’s like surfing the net, but it’s not, because you’re looking for something in particular. (…) OK, I’m going to make sure that I only spend twenty minutes on Google.” (P6)

Some interruptions were not urgent, but participants were used to addressing them anyway if they were presumed to be ‘quick and easy’, so they did not have to remind themselves to attend to it later. The notification however made participants reflect on the occurrence and actual length of these interruptions, and whether they always needed to address each interruption immediately:

“It made me realise how long I was spending, spending/wasting, doing other stuff. I think it affected me in the sense that I wanted to take fewer breaks. Well, by breaks I mean, it’s just going to do something and then ending up chatting with someone.” (P3)

“I need to work on time management and (…) not spending my whole day answering irrelevant queries.” (P9)

## Effectiveness of time feedback for different types of interruption

Participants found the feedback especially useful when they switched to sources they knew were distracting, for example search engines, instant messaging tools, and email. Participants needed to access these sources for work, so it was difficult to avoid them:

“As everyone says, ‘we’ll just switch email off’ (…). But you can bet your life that there will come a moment in whatever task you’re doing you think: Oh! I have to open up email. And the moment you open up your email, that’s it.” (P2)

Two participants (P3, P7) found the extension mostly useful if they were about to interrupt themselves for non-work related activities, as the notification helped as a reminder to either stay focused on the task, or to not spend too long on the interruption. If they however had to be in a different computer window for a while as part of the task, the information was not considered useful:

“I think it'd be really, really useful, but not for necessary work tasks. (…) I’ve been spending 15 minutes on Moodle, and my main page is X or Y. I don’t care to go to that main page or not. So whether you could setup different ‘main’ pages… but then that would be complicated.” (P3)

P7 was the only participant who, upon viewing the time information, was not surprised by the time she spent on work-related interruptions. She considered the amount of time necessary to complete her work and did not see any room to improve on this:

“To me, it doesn't kind of make me think: 'Oeh, I've been away too long'. I just think: OK, well I'm roughly aware that I've been away for an hour (…), I don't see how it kind of links with being more productive. Unless I suppose, you're really easily distracted.“ (P7)

Participants also dealt with interruptions taking place outside of the computer: for example, participants were interrupted by their colleagues or phone calls, or interrupted themselves to print something off. As with digital interruptions, there was again no clear distinction between distracting and work-necessary sources, so participants could not always manage distracting self-interruptions by avoiding these during work:

“My phone is a distraction for me. (…) I put my phone in a tray under a load of documents. But then I’m in Whatsapp work groups. So I converse a lot with a professor via text.” (P9)

Because the extension only provided time information about digital interruptions, some participants felt it provided an incomplete picture of their interruption behaviour. This is illustrated by the following quote from P2 who, upon making a digital interruption, read in the extension that there was no interruption data available yet:

“That's when I sort of thought: 'Oh, that's not really saying much, is it?' Because it's not actually true. Because of course there were interruptions.” (P2)

ManicTime provided participants with information on their non-digital interruptions, and participants considered this a good complement to the information that the extension provided. If the PC was inactive, and participants came back from inactivity, ManicTime presented users with a window on the screen saying how long they had been away for (see Figure ), and gave participants the option to write down what they were doing while they were away.

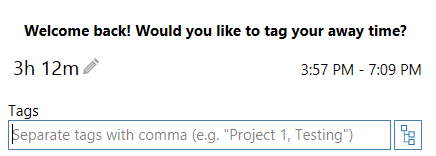


Figure 4. If participants had been away from their computer, upon returning ManicTime presented them with a window showing how long they had been away for, and an option to write down what they had been doing while away.

## Effort to view and use time data

Participants appreciated that the extension presented them with information during a task, as they would forget to look at it otherwise:

*“It needs to be presented to you, to make an impact.” (P6)*

One participant said she sometimes forgot to start and use the extension during busy periods at work. Another participant found ManicTime less intrusive than the extension, because it runs in the background, but also said he failed to remember to open and look at ManicTime, as he was busy with work. In contrast, the notification was a trigger for participants to reflect on their behaviour.

Participants reported that the concise and precise measure of the average interruption time was easy to read and interpret during a task. It was also clear what action to take, and participants read the information to decide whether to reflect on past interruptions. To aid their reflection, some participants wanted to get insight in additional data of what they were doing during these interruptions. P9 combined the extension with ManicTime to contextualise the interruption:

“[The extension] popped up and it said: ”You go away for 7 minutes and 33 seconds. I would then have a browse [in ManicTime] And then I think: oh my gosh, I've been on emails for an hour! I haven't got anything done. So yeah, I checked it quite a lot. More so because I was so shocked. And so, I'm so interested to know, actually, what I'm doing at work.” (P9)

Two participants, who did not have ManicTime installed, wanted to use the extension to see more information. For example, they wanted to see a log of all of their past interruptions, and explore a pattern of their behaviour:

“It [the notification] kept on coming up, (…) and you can't click on it, because it's not taking you anywhere! But yeah, I found that a shame. Because I could see the benefit of it, and it would have been really, REALLY interesting.” (P2)

“I would like to see, just on a weekly basis, exactly what I’m doing, (…) what was productive and non-productive time.” (P6)

However, participants who used ManicTime and did have access to past behaviour, only used the application after being triggered by the notification to see what they had been doing at a specific moment, and rarely used the application to look at patterns of their overall activity or aggregated data. They briefly looked at the rest of the data out of curiosity at the start of the study, but the extensiveness of the ManicTime data made it unclear to participants what action to take from the data. It was considered too effortful and time-consuming to find this out themselves:

“I didn’t go into too much detail with it. One of the reasons is that, it would take me a lot of time and effort to use this information, to help me work better or quicker, or more efficiently. And this is either something that I don’t have time to do, or I can’t be bothered, depending on the day.” (P3)

“I just can't see myself spending the time using something to help me spend time on things! [laughs] I just have quite a lot of things to do, that I’d rather not spend more time organising that, I’d rather just get it done.” (P5)

Potentially giving participants a log of a specific aspect of their behaviour, in this case the occurrence and duration of interruptions during a specific task, will be more valuable than all of their activity, as it can save participants time of filtering and interpreting the data, and help them look at the impact of changing a specific habit over time.

## Effectiveness of time feedback to set goals

A clear interest among participants was to not only see how much time they spent on interruptions during a task, but also how much time they spent on a task overall. Similar to how they used time information to reflect if interruptions were as long as they thought they were, they wanted to reflect if tasks took as long as expected. Furthermore, they would use this information to be more realistic when planning tasks over time:

“So down the line, I’d think it would be extremely useful to know how much time I’m actually spending. Because it would help me be more productive, or be more realistic in the amount of time I need for these things to happen.”(P3)

“I'm quite keen to know how much time I'm spending and doing which task. [In addition to] how much we're away from the task.” (P8)

Currently, participants planned tasks they wanted to complete on either a daily or weekly basis, and implicitly took the time each task would take into consideration. However, given the fragmented nature of their role and the frequency of interruptions, it was difficult to estimate how long they actually spent on these tasks:

“They’re very loose goals, (…) I think that might take me 3 hours, and I’d want to get that done in one day. But yeah, obviously, things quite often take longer than I think I will, because then when I’m doing them, I might get interrupted.” (P5)

“I think time is quite important to monitor, sometimes it goes really fast, sometimes it doesn’t, but this thing is actually telling you exactly what has been happening. (…) Now I have no, I have just a rough measure, which is how I feel, rather than a precise measurement.” (P3)

The interest to see time on tasks was related to the theme that participants wanted to complete as many tasks as possible within a certain time frame, and were driven in their work by tasks and deadlines. Completing tasks made them feel a sense of achievement, and this was also one of the reasons why they addressed an interrupting task immediately, if they thought they could complete it quickly:

“I love that feeling! It is a great, wonderful feeling, psychologically, you think: that’s DONE!” (P2)

“It kind of contradicts what I told you before about (…) how I jump on them [incoming tasks] and finish them. But at the same time, it’s because I don’t want to have three things at once going. I want to finish, finish, finish.” (P3)

“I strive on achieving, and if I’ve not ticked something off my to-do list, I don’t feel like I’ve achieved anything that day. (…) That’s where ManicTime has really helped me, (…) actually look at the log, (…) I do feel like I am achieving, even though on paper, I’ve not ticked anything off.” (P9)

Two participants also wished to set time limits on their interruptions, and get reminders during the interruption to return to a task:

“Say you have to work on that specific document, and then you end up spending half an hour on Slack, chatting to your colleagues, it would be good if something's like: mate, work. Stop doing other things.” (P3)

“Maybe the next stage would be that you set it up where you’re only allowed 30 minutes, and an alarm sound [will go off] to say your 30 minutes are up. So you know what you’re doing, and sort of regulating it, to fit in with what you want to achieve.” (P6)

## Effectiveness of feedback: different work environments

Seven participants worked from home on occasion, and though participants only used the extension in the workplace, their descriptions of their office and home environments indicates that participants may in particular benefit from time information during afternoon work in the office, when participants were more prone to interrupt themselves and get distracted. In general, the office was seen as a more distracting environment and participants saved up tasks that required focused attention to complete at home. They received fewer external interruptions:

“You’re working from home for a specific purpose, and therefore you don’t really want to be disturbed. Unless it’s absolutely urgent.” (P2)

“I get fewer emails, definitely. (…) If I’m not there, 7 out of 10 enquiries, they deal with themselves.” (P9)

At home, participants also reacted to interruptions differently:

“From home it’s a bit different, I normally look at the emails but I generally try not to respond, unless it’s too urgent. But at work, when I’m here, (…) if it is not too urgent, but still I can find that is nice and straightforward, I just straight reply back. But at home it’s more focused, definitely.” (P8)

The office environment not only exposed participants to more external interruptions, but all seven participants reported there were also more sources to get distracted. For example, most participants had multiple computer screens and kept most documents, browse windows and applications open on their work computer, even after they had finished with them. These windows were a further source of distraction if participants were trying to find task-related information in one of the windows:

“It’s like 15 tabs, and I need to go somewhere. And I end up clicking all of them. And if there is one that is personal stuff, I end up reading it. And then five minutes after, I’m like: what was I doing? (…) So it’s distracting in the way that it makes me not solely focused on one thing.” (P3)

In contrast, at home participants worked with one screen and had their main task window maximised. Another participant reported she was also less prone to react to self-interruptions at home:

“When I’m at home, I generally don’t look at my phone for some weird reason. (…) When I’m in the office I find that I’m easily distracted, and I don’t get things done.” (P9)

Though all participants felt that the office environment introduced more distractions during work-related interruptions, two participants expressed that there were still other, personal, interruptions at home:

“There are fewer, but there are still interruptions, but they are of a different kind. I guess in a way some of them are kind of internal interruptions.” (P5)

“Coming to my office makes sense, if you want to work. Staying at home makes sense if you want to chill.” (P3)

# General Discussion

The aim of this paper was to investigate whether showing people how long they go away from a task can reduce the number and duration of interruptions and improve task performance. Our results suggest that time feedback during the task can help people adapt their interruption behaviour in the moment and become more focused on completing a task. Study 1 showed that it reduced the duration of interruptions and made people more accurate and faster in completing a data entry task. Study 2 showed that it made people reflect on what they were doing during an interruption, and as a result they tried to cut out time of interruptions and reduce the number of unnecessary interruptions.

Previous work has highlighted several problems with existing commercial time tracking and management applications: these often are time-consuming to setup, they can restrict user activities too much, and it is not immediately clear to users what action to take based on the data (Collins, Cox, Bird, & Cornish-Tresstail, 2014; Whittaker et al., 2016). Our findings partly corroborate these issues, and demonstrate several pointers to inform the design of time applications.

First, when providing users with a log of their computer activities, they need to have a specific starting point of what it is they want to find out for them to be able to use it and act on it. Participants in Study 2 were not interested in their overall computer activity, but were mostly interested in the time they spent on, or away from, a specific task. By presenting a simple and precise measure, in our case the length of an interruption, participants were provided with a specific target of what to reflect on and change, and did not need to go through the effort of having to interpret information of all their activity. As some participants in Study 2 did want to have access to more detailed information about their activity during a specific interruption, a simple presentation in the moment can be complemented by a more complete log running in the background. It would also be interesting to give users control over what information they are interested in to see in the notification. For example, most participants were not only interested in the length of interruptions during a task, but also on the length of their task overall.

Second, by showing information during the task, participants can change their behaviour in the moment and do not have to remind themselves to look at information later. Participants in Study 2 were prompted by the notification to reflect on what they were doing during an interruption, but often forgot to look back at their computer activities otherwise. Participants in Study 1 were able to act on the explicit information they were given in the short time space of an experiment, which had a positive effect on their task performance.

Another promising area to investigate would be to record the interruptions and give participants insight in how their changes have an effect over time. Although it was clear to participants in Study 2 what action they had to take based on the data presented by the extension, some felt they did not have sufficient information as to whether these changes had any effect over time.

While the results are promising, our research also has a number of limitations which would be worthwhile to address in future work. Our study only focused on digital interruptions, but as was apparent in Study 2, people also deal with interruptions and distractions beyond the computer. Future work could look at also collecting and showing data from these interruptions. For example, ManicTime uses PC inactivity to indicate when participants were away. Other sensitive measures to detect moments where the user has likely interrupted their work could be inter-key intervals or mouse clicks. Furthermore, due to the limited logging data from Study 2, we are unable to make any concluding claims as to whether time feedback had any significant effect on participants’ window switching and task focus behaviour over time. In addition, though participants indicated they modified their behaviour after using the extension, it is not certain whether they based their behaviour on the specific information provided by the extension, or whether the notification simply made them reflect and become more aware of their time.

Our findings make a contribution to our understanding of switching behaviour for routine data entry work to distracting but task-relevant applications such as email. Our results also suggest that a simple presentation of time information during a task can mitigate distractions but still keep users in control over their interruptions, and can inform the design of productivity interventions to improve focus.

# References

Altmann, E. M., Trafton, J. G., & Hambrick, D. Z. (2014). Momentary interruptions can derail the train of thought. *Journal of Experimental Psychology: General*, *143*(1), 215–226. https://doi.org/10.1037/a0030986

Altmann, E. M., Trafton, J. G., & Hambrick, D. Z. (2017). Effects of Interruption Length on Procedural Errors. *Journal of Experimental Psychology: Applied*, *23*(2), 216–229. https://doi.org/10.1037/xap0000117

Collins, E. I. M., Cox, A. L., Bird, J., & Cornish-Tresstail, C. (2014). Barriers to engagement with a personal informatics productivity tool. In *Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures the Future of Design - OzCHI ’14* (pp. 370–379). https://doi.org/10.1145/2686612.2686668

Cutrell, E., Czerwinski, M., & Horvitz, E. (2001). Notification, Disruption, and Memory: Effects of Messaging Interruptions on Memory and Performance. In *Proceedings of INTERACT 2001* (pp. 263–269). New York, NY, USA: Springer.

Gould, S. J. J., Cox, A. L., & Brumby, D. P. (2016). Diminished Control in Crowdsourcing: An Investigation of Crowdworker Multitasking Behavior. *ACM Transactions on Computer-Human Interaction*, *23*(3), 1–27. https://doi.org/10.1145/2928269

Hanrahan, B. V, & Pérez-Qu, M. A. (2015). Lost in Email: Pulling Users Down a Path of Interaction. In *CHI’15* (pp. 3981–3984). https://doi.org/10.1145/2702123.2702351

Katidioti, I., & Taatgen, N. A. (2013). Choice in Multitasking: How Delays in the Primary Task Turn a Rational Into an Irrational Multitasker. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *56*(4), 728–736. https://doi.org/10.1177/0018720813504216

Mark, G., Iqbal, S. T., Czerwinski, M., Johns, P., & Sano, A. (2016). Email duration, batching and self-interruption: Patterns of email use on productivity and stress. In *CHI’16* (pp. 1717–1728).

Monk, C. A., Trafton, J. G., & Boehm-Davis, D. A. (2008). The effect of interruption duration and demand on resuming suspended goals. *Journal of Experimental Psychology: Applied*, *14*(4), 299–313. https://doi.org/10.1037/a0014402

Rzeszotarski, J. M., Chi, E., Paritosh, P., & Dai, P. (2013). *Inserting Micro-Breaks into Crowdsourcing Workflows*. *AAAI Publications, First AAAI Conference on Human Computation and Crowdsourcing*.

Salvucci, D. D., & Bogunovich, P. (2010). Multitasking and Monotasking: The Effects of Mental Workload on Deferred Task Interruptions. In *CHI 2010*. Atlanta, GA, USA. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.157.7522&rep=rep1&type=pdf

Whittaker, S., Hollis, V., & Guydish, A. (2016). “Don”t Waste My Time’: Use of Time Information Improves Focus. In *CHI’16* (pp. 1729–1738). San Jose, CA, USA.