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.

# STUDY 1

# 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 whether the notification would be applicable and used 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 their 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. 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 (see Figure ). 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 from this page during the session, whether to a different web page, document or application, they received a notification indicating how long on average they go away for when switching away from the main task page. 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 browser security limitations, the extension was unable to store any data locally after a session had ended. If participants switched away from a page for the first time, the notification showed a message that no switching data was available yet.

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 a quantitative measure 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 not allowed to install ManicTime on their computer, and only used the extension. The ManicTime data of the remaining four participants that is summarised in this paper is 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 they currently manage interruptions, tasks, time and information, the context of using the extension, the usefulness of the information provided by both the extension and ManicTime, and whether they made made any changes on how they managed their work. 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.

# Results

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 data 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: the type of interruptions, the moment of feedback, the simplicity versus completeness of feedback, the work environment, people’s personal traits and their current management strategies, and people’s goals.

## 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 a typical working day was 10 hours. On average, participants made 862 computer window switches per working day. The distribution of window focus durations is plotted in Figure 4, illustrating that participants were rarely focused on a window for more than a minute.

In addition to computer window switches, participants also made a small number of non-digital interruptions, for example when taking a break or attending a meeting. On average participants made 10 daily non-digital interruptions which lasted about two hours (6667 seconds).

Together with the interview findings, the data further shows that participants’ work was characterised by short durations of focus and frequent window switches.

Table . Average window focus durations (s) and switches.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean (SD) | Median | Min | Max |
| Window focus duration (s) | 33.88 (80.74) | 11.00 | 1.00 | 2893 |
| Daily switches between windows | 861.6 (293.74) | 725.5 | 660.6 | 1198.7 |
| Non-digital interruption durations (s) | 6667.61 (32573.92) | 1170 | 47.00 | 312238 |
| Daily non-digital interruptions |  |  |  |  |



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

# Use of extension

# General 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 et al., 2017; Monk et al., 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 et al., 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 et al., 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 et al., 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.

# 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*. https://doi.org/10.1037/xap0000117

Borghouts, J., Brumby, D. P., & Cox, A. L. (2017). Batching, Error Checking and Data Collecting : Understanding Data Entry in a Financial Office. In *Proceedings of 15th European Conference on Computer-Supported Cooperative Work*. Sheffield, UK. https://doi.org/10.18420/ecscw2017-4

Collins, E. I. M., Cox, A. L., Bird, J., & Cornish-Tresstail, C. (2014). Barriers to engagement with a personal informatics productivity tool. *Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures the Future of Design - OzCHI ’14*, 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. Retrieved from https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/Interact2001Messaging.pdf

Gonzalez, V. M., & Mark, G. (2004). “Constant, Constant, Multi-tasking Craziness”: Managing Multiple Working Spheres. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI ’04)* (pp. 113–120). Vienna, Austria. Retrieved from http://delivery.acm.org/10.1145/990000/985707/p113-gonzalez.pdf?key1=985707&key2=9709385111&coll=GUIDE&dl=GUIDE&CFID=44938518&CFTOKEN=14011566

Gould, S. J. J., Cox, A. L., & Brumby, D. P. (2016). Diminished Control in Crowdsourcing: An Investigation of Crowdworker Multitasking Behavior , *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

Jin, J., & Dabbish, L. A. (2009). Self-Interruption on the Computer : A Typology of Discretionary Task Interleaving. In *CHI 2009* (pp. 1799–1808).

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

Kim, J., Cho, K. C., & Lee, K. U. (2017). Technology Supported Behavior Restriction for Mitigating Self-Interruptions in Multi-device Environments. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol*, *1*(21). https://doi.org/10.1145/3130932

ManicTime. (2018). Retrieved January 9, 2018, from https://www.manictime.com

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 2016*.

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

RescueTime. (2018). Retrieved January 9, 2018, from https://www.rescuetime.com

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 *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 16)* (pp. 1729–1738). San Jose, CA, USA.