Looking up information in email: an online experiment shows people make shorter visits to their inbox when given feedback on the duration of their switches

# 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 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. This suggests that people may have been less inclined to attend to unrelated activities during these switches, such as opening other emails. 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

Data entry is a common task in work settings. In many cases, people have to access multiple sources to find, collect, and enter information (Borghouts, Brumby, & Cox, 2017). When users have to switch between sources, it is often difficult to maintain focus on the task (Gonzalez & Mark, 2004). It opens up opportunities to get distracted, and a switch to look up information may take longer than intended. In addition, people can further self-interrupt their work for unrelated activities (Jin & Dabbish, 2009).

In order to improve focus and mitigate self-interruptions, Kim, Cho and Lee (2017) developed an intervention that allowed people to temporarily block specific sources that they considered distracting, such as email, IM applications and social media. However often these sources then needed to be accessed after all for the task they were working on. Other commercial applications do not block sources but instead provide users an overview of their computer activities, to reflect how much time they spend in total on tasks, and certain sources (“ManicTime,” 2018, “RescueTime,” 2018). However, as these tools provide information of past usage, it is often not clear to users what they have to do with the data (Collins, Cox, Bird, & Cornish-Tresstail, 2014), and there is little evidence of their effectiveness in improving focus (Whittaker, Hollis, & Guydish, 2016). Gould, Cox and Brumby (2016) looked at switching behaviour during online crowdsourcing work, and found that an intervention during work that encouraged people to stay focused after people had interrupted reduced number of switches to unrelated tasks. Recognising that switches occur as part of the task, we consider whether the duration of switches can be reduced by giving people real-time feedback on how long they switch away for during a data entry task. This is important to consider, because the longer people interrupt, the more disruptive it is (Monk, Trafton, & Boehm-Davis, 2008), and the harder it is to resume a task (Altmann, Trafton, & Hambrick, 2017).

This study aims to investigate whether an intervention showing people how long they switch on average has an effect on the duration and number of switches during a data entry task. An online experiment was conducted where participants had to complete a data entry task. Participants had to enter numeric codes into a form, which they had to retrieve from a message sent to their personal email. We deliberately chose to present the information as a message in participants’ email inboxes, as email is an integral part of data entry work but known to be a source of distraction, and people often spend more time on it than originally intended (Hanrahan & Pérez-Qu, 2015; Mark, Iqbal, Czerwinski, Johns, & Sano, 2016). We therefore expected it to have a distracting effect during the switches to look up information. Half of the participants received feedback on the average length of their switches through a browser notification. Our results show that the experimental group who received a notification made shorter switches than the control group. In addition, they completed the data entry task faster and made fewer data entry errors.

# Method

## Participants

Thirty-two participants (19 women) took part in the online experiment. Ages ranged from 22 to 63 (M = 29.7 years, SD = 8.6 years). The participants were recruited via university email lists, social media and online platforms to advertise academic studies.

## Design

The study used a between-participants design with one independent variable, a notification. In the *control* condition, participants did not receive a notification, but switches away from the data entry window were recorded. In the *notification* condition, participants were shown a notification every time they completed a trial. This notification showed how long on average they were away for when switching away from the window, before returning to the task. The purpose of this notification was to see if the number and duration of switches could be reduced by giving participants feedback on the time spent of on switches. Dependent variables were number and duration of switches away from the data entry interface, trial completion time, and data entry errors. Switching behaviour was recorded using JavaScript’s blur and focus events. These were triggered whenever a participant switched away from the data entry window, whether to their email inbox or to a different window or application.

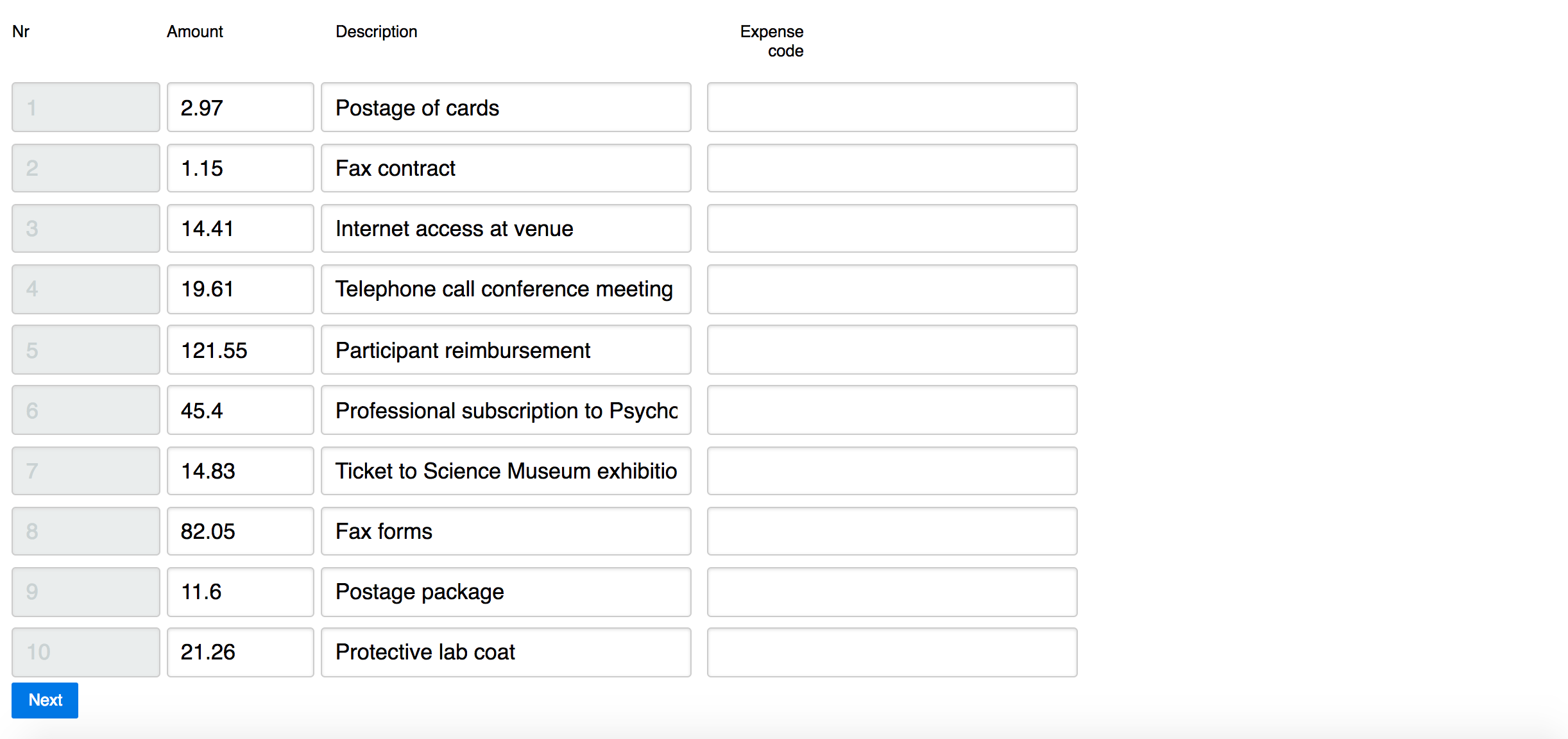


Figure . The data entry task as shown in the browser. Participants had to enter the correct expense code for each expense.



Figure . The table showing the expense types and corresponding codes, which was sent to participants in an email message.

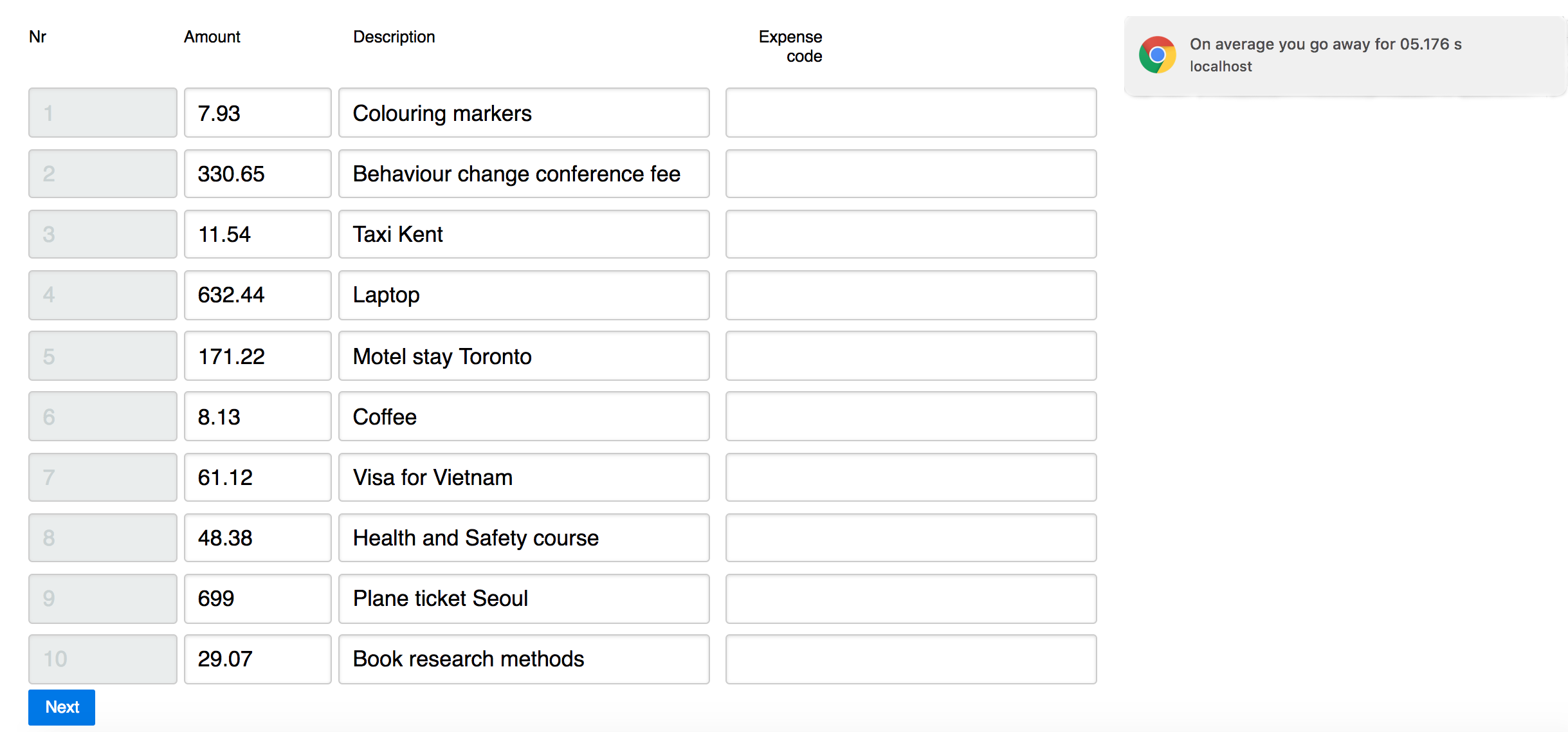


Figure . The feedback participants received on how long they are away for on average in the *notification* condition.

## Materials

The task used was based on a common routine data entry task involving processing expenses (Borghouts et al., 2017). Participants were presented with an online sheet containing a set of ten ‘expenses’ (see Figure 1). They had to complete each row by entering the correct expense code for the expense. They retrieved this code by looking it up in a table of 25 expense categories which each had a corresponding 5-digit expense code, shown in Figure 2. Participants had to determine which category an expense belonged to, look up the code of this category and enter it in the row of the expense. We used expense categories and codes that are currently used by a public university to process expenses.

In the example of Figure 1, the expense in the top row belongs to the category ‘Postage’ and the participant would have to copy the code 22104 from the expense table into the empty cell of the top row. A code did not occur more than once in a trial. The codes within a trial could be entered in any order.

Once the codes of the ten expenses had been entered, participants clicked the Next button to go to the next trial and the sheet was filled with ten new expenses. Participants were not alerted to any mistakes and once they had pressed ‘Next’, they could not return to the previous trial to correct any errors. Participants had to complete one practice trial, and five experimental trials. The purpose of the practice trial was for the participant to get familiar with the task, and the recorded data from this trial was excluded from the analysis.

The experiment was conducted in a web browser. In addition to the main task, we implemented a browser notification that appeared when participants in the *notification* condition switched away from the data entry window (see Figure 3). Every time participants switched, a notification appeared at the right-hand corner of their screen that told participants how long on average they go away for when they switch. The notification stayed visible for several seconds as set by default by the browser, or participants could dismiss the notification themselves by clicking on it.

## Procedure

The study was advertised online with a brief description and a website link to sign up. Participants signed up for the experiment by entering their email address, and were sent an email with the table of expense categories and expense codes. The email also included instructions with a new link where the study was available. Participants were asked to complete the task on a desktop or laptop computer and open the experiment in Google Chrome, Firefox or Safari. Participants were not informed beforehand which condition they had been allocated to, and were told the purpose of the study was to understand how people perform data entry tasks. Participants in the *notification* condition were informed that they would receive notifications during the experiment.

Participants first read an online consent form on the website, and were not able to continue to the experiment until they had agreed to the consent form. Participants in the *notification* condition received an additional dialog box to enable notifications in their browser, and had to click ‘OK’ to continue. Participants were instructed to have both their email and data entry window open on the same device, and to keep both windows maximised at all time, to ensure they had to switch back and forth between the two windows. Participants who made no recorded switches would be excluded from the dataset.

After completing all experimental trials, participants were shown a page of debriefing information, explaining the purpose of the study. An email address was included as a point of contact if participants had any further questions. Participants took between 10 and 20 minutes to complete the experiment.

# Results

Table 1 summarises the results of the conditions in terms of the four dependent variables. The number of switches, length of switches and the error rate were not normally distributed, so non-parametric Mann-Whitney tests were used to analyse effects of a notification on these dependent variables. A Shapiro–Wilk test suggested that the trial completion times were normally distributed, W = 0.94, p = 0.05, so an independent t-test was used to analyse the effect on trial times.

Figure 4 shows the variability of duration of switches for the two conditions. Results show that switches were significantly shorter among participants who had a notification (M=4.51s, SD=1.80s) than among those without a notification (M=7.11s, SD=3.14s), U(17, 15) = 186, p = 0.01. There was no significant difference in number of switches, U(17, 15) = 80, p = 0.1.

Error rates were calculated by dividing the number of data entry errors divided by error opportunities. The error rates were significantly lower for participants with a notification (M=2%, SD=2%) compared to participants who had no notification (M=6%, SD=6%), U(17, 15) = 190, p < .01. Participants with a notification were also faster in completing trials (M=94.98s, SD=17.69s) compared to participants without a notification (M=122.90s, SD=35.43s), t(30) = 2.96, p < .01.

Table . Means and standard deviations of dependent variables for each condition.

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| --- | --- | --- | --- | --- |
| Condition | Number of switches | Duration of switches (s) | Error rate | Trial completion time (s) |
| Control | 10.26 (1.29) | 7.11 (3.14) | 6% (6%) | 122.90 (35.43) |
| Notification | 10.80 (1.60) | 4.51 (1.80) | 2% (2%) | 94.98 (17.69) |

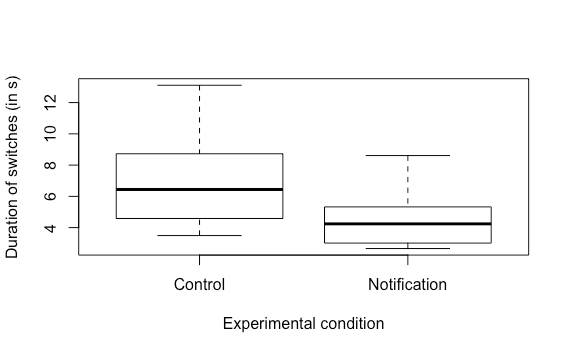


Figure . Boxplot of duration of switches away from the data entry interface in each condition.

# 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.