Interruptions in Diagnostic Radiology: Is there a Tradeoff between Speed and Accuracy?

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Rationale

Radiologists work in highly disruptive, high stakes environments. A recent observational study found that an interruption occurs every 12.1 minutes during regular business hours (Ratwani, Wang, Fong, & Cooper, 2016). Furthermore, the shifts with greater phone-call volume are associated with an increase in the number of discrepancies between readings (Balint, et al., 2014). In our recent work, we used an experimental design to quantify the effects of interruptions on search through chest CT scans with simulated nodules (Williams & Drew, 2017). We found that interruptions led to an increase in search time, but there was no effect on diagnostic accuracy. Eye-tracking measures revealed an increase in refixation rate in the moments following the interruption, which predicted an individual's overall time cost. This suggests that the increase in search time is caused by an inability to remember which regions of the image were searched prior to the interruption. However, despite this impairment, an equal number of abnormalities were detected across both conditions. Given an unlimited search time, observers might have been able to avoid errors by spending more time on the interrupted cases. However, radiologists are often under substantial time constraints and might not have sufficient time to recover from every interruption. The goal of the current study was to investigate the effects of interruptions when there is a finite amount of time available to search each image. We hypothesized that these time constraints would lead to more errors for interrupted cases.

Methods

Novice participants (n=24) searched through 20 chest CT scans for artificial lung nodules. During half of the CT scans, search was interrupted by a series of 10 true or false math equations between 20 and 40 seconds following search onset. Participants were allotted 60 seconds to complete each CT scan and received a 15 second warning before the time was up. The time spent on the math problems did not count toward the allotted search time, and participants were instructed to be as accurate as possible on both tasks.

Results

There were no differences in nodule detection rate between interruption (M = 54.8%, SD = .17) and control (M = 53.5%, SD = .15) trials, t(23) = .51, p = 61. The average number of false alarms

per case did not differ between interruption (M = .31, SD = .71) and control (M = .25, SD = .65) trials, $t(23) = 1.13$, $p = .27$.

Conclusions

Despite the connection between errors and interruptions found in observational studies, we have consistently failed to find this relationship using an experimental design (Williams & Drew, 2017; Aldred, et al., 2016). In the current study, we found that interruptions did not increase error rates even when observers searched under time constraints. Future studies should further investigate the factors that lead to errors in diagnostic radiology. Not all interruptions are equally disruptive; one promising line for future research will be to examine whether interruptions that involve stronger connections to medical image perception may produce the predicted costs in diagnostic accuracy.