The cost of distraction: Quantifying the effects of interruption during diagnostic radiology using mobile eye tracking

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Rationale

Radiologists are frequently interrupted while performing tasks where a simple mistake may have dire consequences for the patient. What are the costs of these sorts of interruptions? The cognitive psychology literature suggests that there will be clear costs on both the speed and accuracy when tasks are interrupted. Moreover, some observational research has found that the number of discrepant diagnoses increases with the number of phone calls during a given shift (Balint et al., 2014). By some estimates, ~30% of all errors during diagnostic radiology are due to perceptual errors (Berlin 2007). We wondered whether increasingly frequent interruptions that occur in the reading room could be contributing to this problem.

Methods

Thirty-two radiologists (Rs) participated in two experiments: 16 at the University of Utah (Experiment 1) and 16 while attending RSNA (Experiment 2). The experiment took place at a modified workstation with 2 (RSNA) or 3 (Utah) monitors. Rs were given a worklist and told to read through the cases as quickly and accurately as possible. The worklist was populated with a mixture of volumetric (e.g. Chest CT) and 2d (e.g. chest radiograph) images. Rs were asked to dictate their impressions of each case. Diagnostic accuracy was coded based on dictation. In Experiment 1, Rs were interrupted on two cases by a phone call. Upon answering the phone, a pre-recorded message asked them to find a patient in a different worklist and provide a quick diagnosis for a patient. In Experiment 2, Rs were interrupted by a Research Assistant who asked them to stop reading the case they were working on and fill out a form with demographic information. In both experiments, the cases that were interrupted were manipulated across Rs so that an equal number of Rs saw each critical case with and without an interruption. We monitored eye-position throughout both experiments using mobile eye-tracking glasses.

Results

In Experiment 1, we observed a significant increase in the amount of time spent on cases that were interrupted (Mean: 529s Interrupted, 367s Uninterrupted: $t(14)=4.5$, $p<.001$), but no cost on diagnostic accuracy ($t(14)=1.17$, p=n.s.). The observed time cost may have been driven by an increased proportion of time spent looking at the dictation screen and a decreased amount of time examining medical images on interruption trials. In Experiment 2, there was no time cost associated with the interruption (Mean: 365 Interrupted, 416s Uninterrupted: $t(14)=-1.75$, p=n.s.). Similarly, the proportion of time spent looking at medical images was unaffected by the interruption.

Conclusions

Our results clearly indicate that the nature of the interruption has important implications for how it will influence performance. We observed a large time-cost when the interruption involved looking at additional medical images and none when it did not. This suggests that the degree of overlap between the primary task and the interrupting task is an important predictor for the resultant cost of interruption. In ongoing work with naïve observers performing an analogous task, we are currently examining whether this prediction holds true.