A great deal of interest concerns the study of vigilance performance, and trust in automation, due to their implications for public safety. This work provides an experimental resource for scholars in need of a vigilance style task. The dataset includes 150 X-ray images of luggage, and participants indicate whether or not they believe each image contains a dangerous item (simulating airport security screening). Using a sample of 991 adults recruited via MTurk, we normed these items in terms of difficulty. These stimuli can be used to study vigilance performance, trust in an automated decision aid, and other areas.

Keywords: Vigilance; Visual Search; Signal Detection; Automation

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(1) Overview

Context

Collection Date(s)
Fall 2018

Background

Vigilance is defined as “the ability of organisms to maintain their focus of attention and to remain alert to stimuli over prolonged periods of time” [1, p. 433]. Vigilance tasks, then, are tasks that require sustained attention to identify rare, but important stimuli over a length of time [1, 2, 3]. Research suggests that humans are poorly suited to vigilance performance; a marked decrease in vigilance performance occurs after approximately 15-30 minutes [3, 4, 5, 6, 7]. Concern over this ‘vigilance decrement’ and associated performance errors has inspired researchers to seek methods of alleviating the vigilance decrement [e.g., 8, 9, 10, 11, 12, 13, 14]. Other researchers have focused specifically on the vigilance task of monitoring automated systems for errors, and they have used vigilance tasks to examine automation use, complacency, and associated issues [e.g., 15, 16, 17, 18].

The X-ray screening task was popularized by Merritt and Ilgen [17], who used it to examine participants’ trust in a fictional decision aid. They proposed that the task can be considered a “microworld” in that it contains essential elements of a real-life situation but also provides the opportunity for increased experimental control [19, p. 65]. Participants view a series of images of X-ray luggage containing various items, some of which may be dangerous (guns or knives). Participants’ task is to indicate whether or not each image contains a weapon.

(2) Methods

Sample

991 U.S. adults (18+) were recruited via Amazon Mechanical Turk (MTurk) and compensated $4.00. Average age was 36 years (sd = 11.17). The sample was 56.6% male, 43.1% female, and 0.3% other genders. Racially, they were 73.7% white/Caucasian, 12.1% African-American, 4.6% Latin, 5.3% East or South Asian, 2.6% multi-racial, and 1.6% other ethnicities.

Materials

Scans of individual items (e.g., a baby bottle, a pair of shoes, a cell phone) were provided by the Transportation Security Administration for research in approximately 2003. The researchers then created luggage images by combining selected individual items into top-down views of scanned luggage. This was done by layering, rotating, and positioning the individual items as needed using Adobe Photoshop. This process resulted in 150 luggage images, 20% of which contained weapons. The images varied in the number of items contained and the degree the items overlapped. The images were consistent in terms of their overall size and luminance.

Procedures

To curtail respondent fatigue, each respondent viewed half of the 150 X-ray stimuli (each X-ray image was rated by ~500 respondents). For each image, if the participant
believed the image contained a weapon, they selected “search.” If not, they selected “clear.”

The study took participants 23.38 minutes on average. Each slide was viewable for as long as the participant liked, and there was no programmed delay between slides. In order to keep participants as naïve as possible, no performance feedback was provided. In addition to completing the X-ray task, participants completed 5 demographic items (before the X-ray task) and 81 self-report items related to another study (after the X-ray task).

Due to limitations of randomization in our survey platform, we created four sets of slide combinations. The combinations were equal in the number of slides containing weapons, and they ensured that each item appeared in two of the four sets and thus, should be evaluated by approximately N = 500 participants. Participants were randomly assigned to a slide set, and the order of the slides within each set was randomly assigned for each participant.

**Quality Control**

Respondents viewed a video-based training instructing them on what items to search for (i.e., guns and knives). The training video was just under 3 minutes long and is available in the repository. Following the training video, they were required to pass a multiple-choice attention check question about the instructions in the video; specifically they needed to correctly indicate that they should click “search” if the image contains a gun or knife, but not any other items. All respondents in our sample passed the attention check, with 92.8% passing on the first attempt and the remaining 7.2% passing on the second attempt.

**Ethical issues**

This research complied with the American Psychological Association Code of Ethics and was approved by the Institutional Review Board at the University of Missouri-St. Louis. Informed consent was obtained from each participant. Data were identified only by a random ID number.

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**Dataset description**

**Object name**
X-RayImages-05-16-2019.zip
2019_09_19_Xray_Image_Norms.xlsx
XrayTraining.mp4

**Data type**
Primary Data
Processed Data

**Format names and versions**
The images are available as .jpg files. The slide norms are presented in Excel format, and the training video is mp4.

**Data Collectors**
The online data collection through MTurk was supervised by Dr. Stephanie M. Merritt in Fall 2018.

**Language**
English

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