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Effectiveness Evaluation of Search and Target Acquisition Training Prototype Using Performance Metrics With Eye-Tracking Data

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Despite the increased use of sensor technologies, including unmanned vehicles, the vast majority of improvised explosive device (IED) detections are made by human vision. Thus, TRAC-Monterey developed a simulation-based training prototype called the perceptual learning trainer (PLT). Fourteen novice and 5 expert IED detectors participated in human-in-the-loop experiments in which all participants were trained using the PLT tool while their eye-movement and IED detection performance were tracked in real-time. A series of 100 IED images with various degrees of difficulty was used for the training session. Pre- and posttraining assessments were conducted. Both speed and accuracy improved after just 1 session of the PLT training: RT decreased by 3.7 s for novices ($p < .001$) and 3.4 s for experts ($p = .031$), and detection probability increased by 5.9% for novices ($p = .001$). The PLT tool improved IED detection performance more in novice IED detectors than in experts. Novices and experts showed different visual scan patterns.

Keywords: search and target acquisition, IED (improvised explosive device), target detection, perceptual learning, eye tracking, signal detection theory

Despite the increased use of sensor technologies, including unmanned vehicles, the vast majority of improvised explosive device (IED) detections are made by human vision. Soldiers have always faced the task of identifying potentially threatening objects in a natural environment. An individual soldier moving through the environment on a foot patrol is faced with the task of conducting a visual search of the scene with each step. The soldier's attention is likely divided between several cognitive tasks based on the context of the mission and his or her role in the mission. These feature associations serve to assist in guiding his search toward the features he judges to be the most salient. This top-down processing of the scene drives the observer to rapidly identify those features that are most likely to provide the contextual cues of a threat. These features are then used to drill down to lower-level attributes if an immediate detection and identification is not possible, but the feature or conjunction of features is consistent with the evidence of a threat.

IEDs are not a new method of attack, but they are some of the most effective and difficult to counter in the current operating environment. A device can be placed in any number of locations to minimize its detectable signature. An IED

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