ECOLOGICAL VISUAL SEARCH UNDER NOISE STRESS: PRESENT & FUTURE RESEARCH

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Visual search is an important part of any tactical mission, whether the combat scenario is person vs. person, person vs. machines, or involves the operation of remotely controlled vehicles. Moreover, search for targets or terrain is particularly crucial when objects to be sighted are moving or are hiding. One goal of emerging technologies such as augmented battlefield displays is to optimize a soldier's efficiency for acquiring visual targets by supplementing the visible world with artificial information that highlights critical areas of interest. Overall, little research has examined visual search under augmented conditions. Nonetheless, several decades of basic research on visual search has produced ample theory and a solid foundation for developing principals for the effective use of this new technology. The focus of our present research effort is to build upon the well-established findings that the human visual system has a preference for particular types of stimuli and patterns of movement.

The overall goal of the purposed research is to examine how visual search in an augmented or virtual environment is affected by the ecological validity of the situation. For our purposes, ecological validity is the degree to which the user environment obeys the perceptual "rules" of the world. For example, concerns for ecological validity include the visual appearance of the stimulus, the degree to which target movement and trajectories are realistic, and the relationship between the context of the scene and the location of the target.

Previous Research

Our previous work in the area has focused on a construct called "search memory", or memory for items that already passed through the visual attention of the observer. This aspect of visual search is crucial in combat because one must quickly search for targets while retaining the locations of other potentially lethal targets. We have shown that the difficulty of certain types of visual search (as seen in studies using randomly moving geometric forms) can be alleviated when the items to be searched are human forms moving along random trajectories (Diaz, Sims, & Hancock, 2002). In contrast to previous research finding that random movement of iconic symbols interferes with the use of search memory (Gibson et al, 2001), these findings suggest that the ecological nature of the stimuli used here may mediate the efficacy of search memory. This finding has implications for the design of augmented environments which use geometric forms to represent important targets. Such attempts to alleviate workload may actually induce greater effort and result in lower response accuracy. Thus, one possible solution is to implement an ecologically-valid means of display augmentation.

We have extended our research on search memory by examining the effect of environmental stress on visual search performance. Specifically, we compared performance on an ecologically-valid search task with and without the presence of unpredictable bursts of white noise. Such conditions begin to provide an analog for visual search that may take place in oppressive and stressful environments experienced during combat situations. Results from this study indicate that effectiveness of search memory may be affected by noise stress. Specifically, noise differentially affected the tradeoff between speed and accuracy of responses such that, searches requiring use of

search memory were quicker and less accurate than searches not relying on search memory.

Future Research

The focus of our present research is to further tease apart the effects that the physical shape of the stimuli and the manner in which it moves has on search effectiveness. Specifically, we aim to more clearly characterize ecological-validity by conducting visual search studies using a range of dynamic and static stimuli. Furthermore, we are interested exploring the effect that different levels of noise stress will have under these search conditions. Due to the multi-dimensional nature through which stress can affect human performance, we will utilize the Dundee Stress State Questionnaire (DSSQ) to more precisely assess the specific means by which noise influences search performance.

References

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