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Change Detection in a Virtual Environment

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Agenda

- Introduction
- Background
- Research Questions
- Pilot Studies / Initial Work
- Hypothesis
- Methodology
- Initial Results
- Future Work
- Questions

Introduction

- COE demands unique skill set
- Those operating frequently in COIN visit same terrain
- No formalized method of training environmental awareness for change detection tasks
- Improving change detection skills mitigates risk of attack
- Accelerating a Soldier's skill at recognizing change should become an important part of pre-deployment training
- First 100-days considered the most risky to Soldiers
- Improving memory and change detection skills could greatly reduce the number of days the Soldier is at the most risk

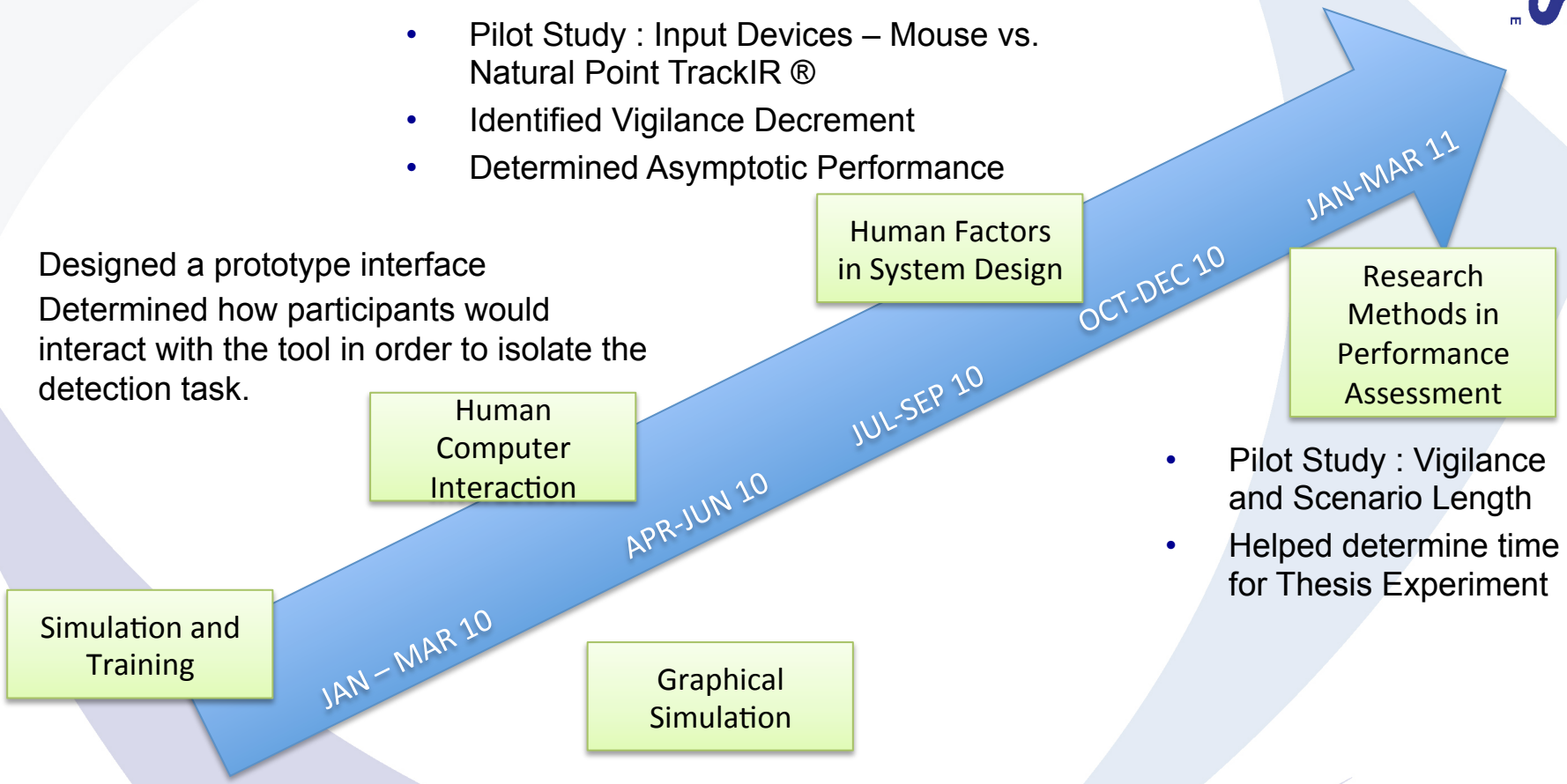
Background

- Signal Detection Theory
  - Signal
  - Noise
- Improving sensitivity to signals in the noise is the goal
- Change detection requires memory of the environment

Research Questions

1. Does change recognition performance improve over time in a virtual environment?
   i. Recognition that something has changed generally. (Detection Percentage)
   ii. Confidence level of recognition and identification of change. (Ordinal scale)
2. How do detection percentages differ when assessing a participant's performance on a variety of threat difficulty levels?
3. How does automated virtual training affect change detection percentages?
4. Does the percentage of recognized changes and false alarms grow proportionally? Or, can the detection percentage improve while simultaneously decreasing the false alarm rate through repeated exposure to a simulated environment?

Pilot Studies / Initial Work



- Developed Concept of Operations
- Identified 12 major lines of operation / training needs

- Designed a prototype interface
- Determined how participants would interact with the tool in order to isolate the detection task.

- Developed prototype in Delta 3D
- Initial evaluation of target objects in the training simulation

- Pilot Study : Input Devices – Mouse vs. Natural Point TrackIR ®
- Identified Vigilance Decrement
- Determined Asymptotic Performance

- Pilot Study : Vigilance and Scenario Length
- Helped determine time for Thesis Experiment

Hypotheses

1. Service members' ability to detect changes (changes detected) will improve over time in a virtual environment.
2. False alarm rates will decrease over time in the virtual environment.
3. There is an interaction between the number of training sessions and the difficulty of objects detected in the virtual environment.

*Exploratory hypothesis aims to explore any increase in confidence levels and detections based on threat salience.

Methodology - Participants

N = 15

3 | 2 | 6 | 2 | 2

Play Video Games?

9 – YES
6 – NO

Rank

1x O2 | 6 x O3 | 8 x O4

Avg Age:
34

Age Range:
28 - 41

Gamers?

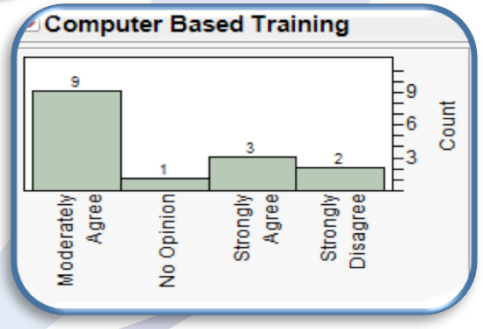
7 – YES
8 – NO

Gender:

15 – MALE
0 - FEMALE

Ground Combat Experience?

3 – YES
12 – NO



Methodology - Procedure

- 15 participants randomly divided into 2 groups blocked on characteristics of service, rank, combat experience, and gaming :
  - Group #1 : No Training
  - Group # 2 : Training
- IRB Waiver and Demographic Survey
- Each participant experienced 12x15-minute sessions, over 4 weeks
- 3x Sessions per week:
  - #1 Baseline
  - #2 Detect Changes : Noise Only
  - #3 Detect Changes : Signal & Noise (30-targets per scenario)
  - Repeat
- Training Group received 3-minute virtual tutor before Session # 1 and Session #7
  - Demonstrated possible threat indicators in virtual environment
  - Showed a few examples of specific changes
- Exit Survey

Methodology - Materials

- Virtual Battlespace 2 (VBS2) ® Army
- Desktop PC, Windows 7
- Intel I7 930 CPU @4.1 Ghz
- 12 GB DDR3 RAM
- 2x Nvidia GTX 480 Video Cards (SLI)
- 32 inch Monitor, 1920 x 1200 resolution
- 3D Audio Headphones
- Microsoft Gaming Mouse
- VBS2 set at max details, rendering objects to 1500 m
- C, V, and B keys bound to script files which check for presence of a changed object within the user's field-of-view when pressed.

Initial Results

- Sharp decay in False Alarms from an average 29 per session down to 4 per session.
- Increase in detections from 15 per session to 23 per session.
- Increase in detections for both scenarios from iteration 1 to iteration 2.
  - Greatest increase from Test 1 to Test 3 (Scenario 1)
  - Second iteration of each scenario almost identical average number of detections.
- Automated virtual training showed negligible benefits.

Future Work

- Compare results in virtual environment to traditional Signal Detection methods using still pictures
- Randomize changes
- Randomize Noise and Signal + Noise sessions
- Test with more representative sample
  - Initial Entry Trainees (IET Soldiers / Marines)
  - All combat arms
- Collect data on trainees in theater to gather impressions of change detection ability

Questions?

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