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PATTERN RECOGNITION SOFTWARE: FUNCTIONAL METHODOLOGY DOCUMENT

Capstone Project Paper

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Abstract

This document examines the need for pattern recognition software in today's military. It outlines a training methodology that will result in better intelligence collection and analysis. The document also outlines the functional requirements of the training software. Finally, it discusses a data architecture technique that will use a software support suite—consisting of a module designer tool and an administration tool—that will provide for maximum adaptability and adoption across the entire Army.

“To penetrate the heart and soul of the problem of improving analysis, it is necessary to better understand, influence, and guide the mental processes of analysts themselves.”

-Richards J. Heuer Jr.¹

Project Justification

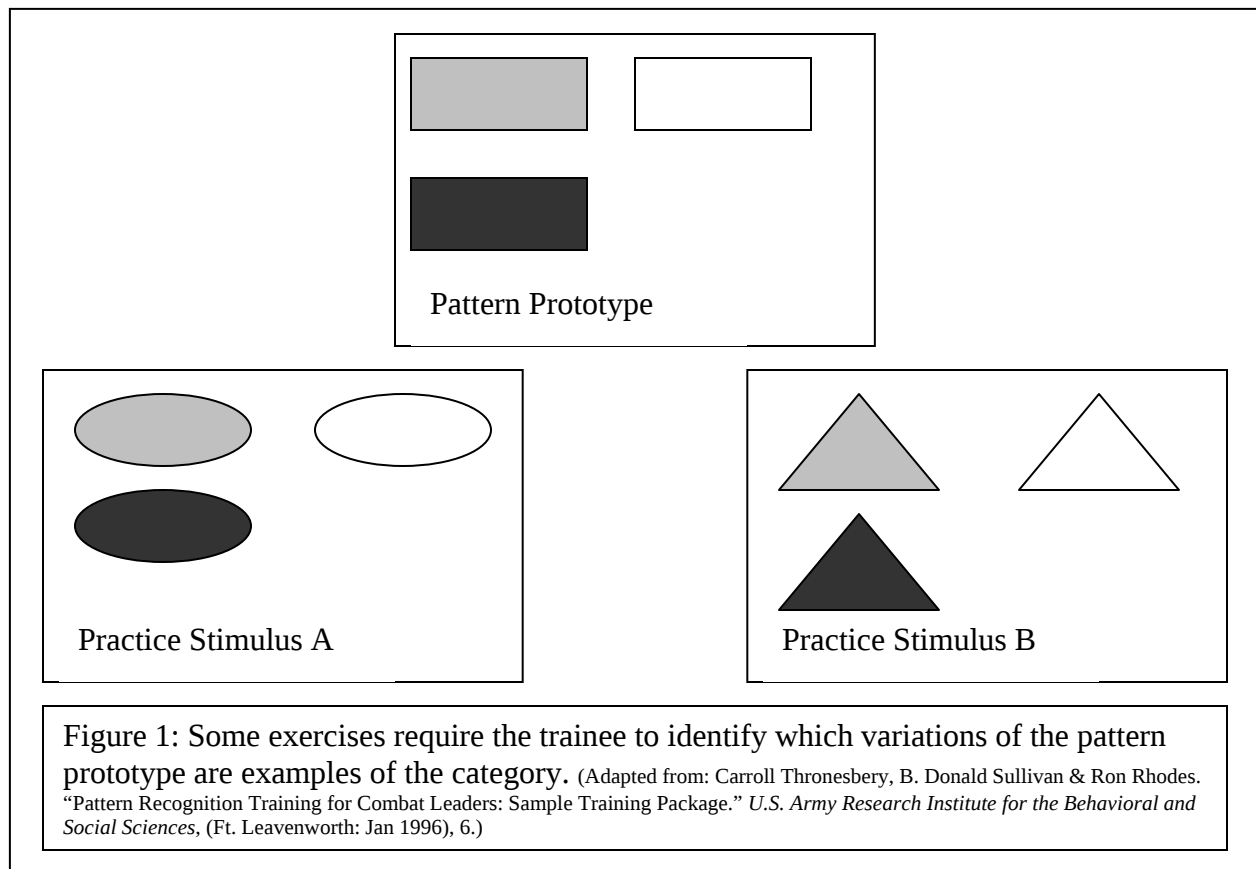
A Soldier cannot break down each of the millions of inputs he gathers on a patrol and analyze it for intelligence. The environment is too complex. Although the S2 will guide collection, effectively telling the Soldier what to look for, the Soldier will see much more than those specific items he is told to reconnoiter. The most effective intelligence collection will take place at the lowest level by Soldiers trained to recognize patterns of normal and abnormal activity in the Area of Operations (AO); this fact is the underlying principle behind Every Soldier is a Sensor (ES2).² Yet in both ES2 and the intelligence analysis that guides it, the Soldier cannot simply know what to look for; he must also learn *how to see it*.

In an environment of constant adaptation, it's critical that the Soldier not look only for the repetition of past patterns. Additionally, he must decipher the evolving code of insurgent behavior if he is to effectively and consistently return from a patrol or convoy. The Soldier that is adept at pattern recognition will be able to spot indicators of new enemy Tactics, Techniques and Procedures (TTPs). Instead of simply reporting the aftermath of an IED emplacement, for example, the Soldier will be able to find patterns that will allow him to interdict the emplacement before it is too late. He will also be able to teach his battle buddies the patterns he observed and thereby save more lives.

Finding patterns in logistics, communications, and financing will also allow analysts to recommend targets that will devastate enemy networks. This pattern recognition is of a higher order than simple TTP recognition, yet it is even more necessary because it moves the counterinsurgent into the offense. TTP recognition alone creates a defensive mentality that allows the initiative to remain with the insurgent. By recognizing patterns in the critical

components of the enemy's operation, the intelligence professional can make his predictive analyses timelier and more accurate.

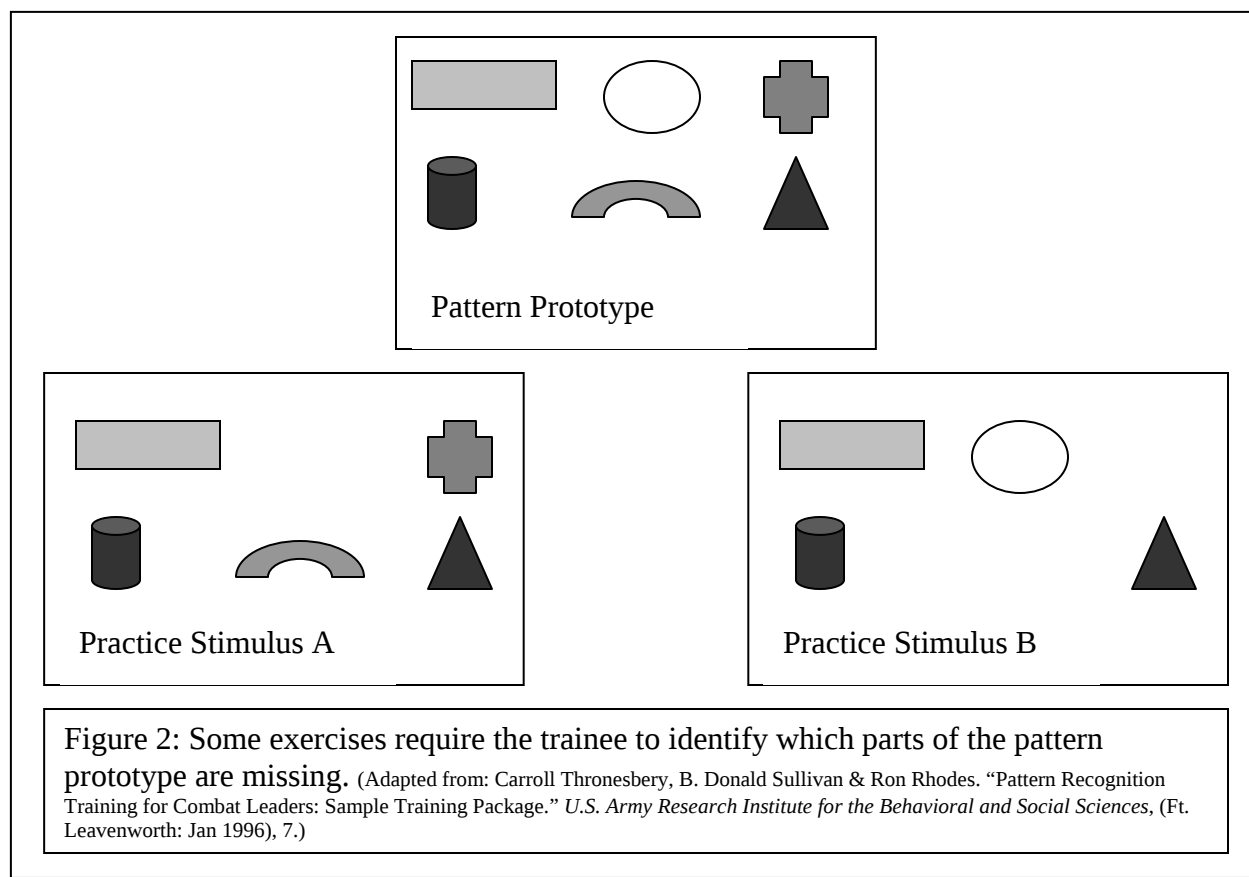
The best teacher for pattern recognition is experience. Although the best experience is hard-earned on the battlefield, an effective software package can and should build an experiential foundation for Soldiers before they deploy. Furthermore, computer-based training can teach theoretical pattern recognition as well as practical patterns based on in-country case studies. The software, then, will simultaneously keep Soldiers up to date on the latest TTPs while it teaches Soldiers how to find the patterns indicative of an emerging TTP. Pattern recognition software will build the right kind of experience in every Soldier so the U.S. Army can learn quicker and be more adaptive than its current, unconventional adversaries.



Training Methodology

The training will be organized into modules that teach specific pattern prototypes and test the user's recognition ability. Each training module will consist of no fewer than three sample patterns and a block of instruction on the characteristics of the pattern prototype and why the three samples fit into the group. The training modules should also demonstrate near-patterns that are close but do not fit into the group; the software's instruction functionality should indicate why the near-pattern does not fit within the prototype. The instruction itself will be both written and verbal. After the block of instruction, the software will test the user's ability to categorize stimulus patterns into the pattern prototype and to recognize the elements that are missing from near-patterns.

The modules themselves will progress in difficulty. Users will be required to complete the basic modules before moving on because research indicates that over-learning simple concepts will make them instinctive.³ Furthermore, building an expertise in simple tasks will facilitate quicker progression because students will have, in effect, already learned the more advanced concepts through examining their component parts.⁴



The least difficult modules will train the concepts of pattern recognition, using simple colors and geometric shapes. Intermediate modules will cover observations, insights and lessons (O.I.L.) from Soldiers that have recently returned home or are still in-country. These intermediate modules will focus on common TTP patterns for things like IED emplacements, VBIED tactics and complex attack setups. There are many existing resources for these data, including the Center for Army Lessons Learned (C.A.L.L.) and the MI Net. The module designer tool, described below, will allow trainers to pick those topics most relevant to their needs and select the best resources for developing their own pattern modules. The software will portray intermediate modules with diagrams, videos and images. Advanced modules will focus on the critical components of insurgent operations—logistics, recruiting, training, communications and financing. The software will use link diagrams, time-event charts, activities/association matrices,

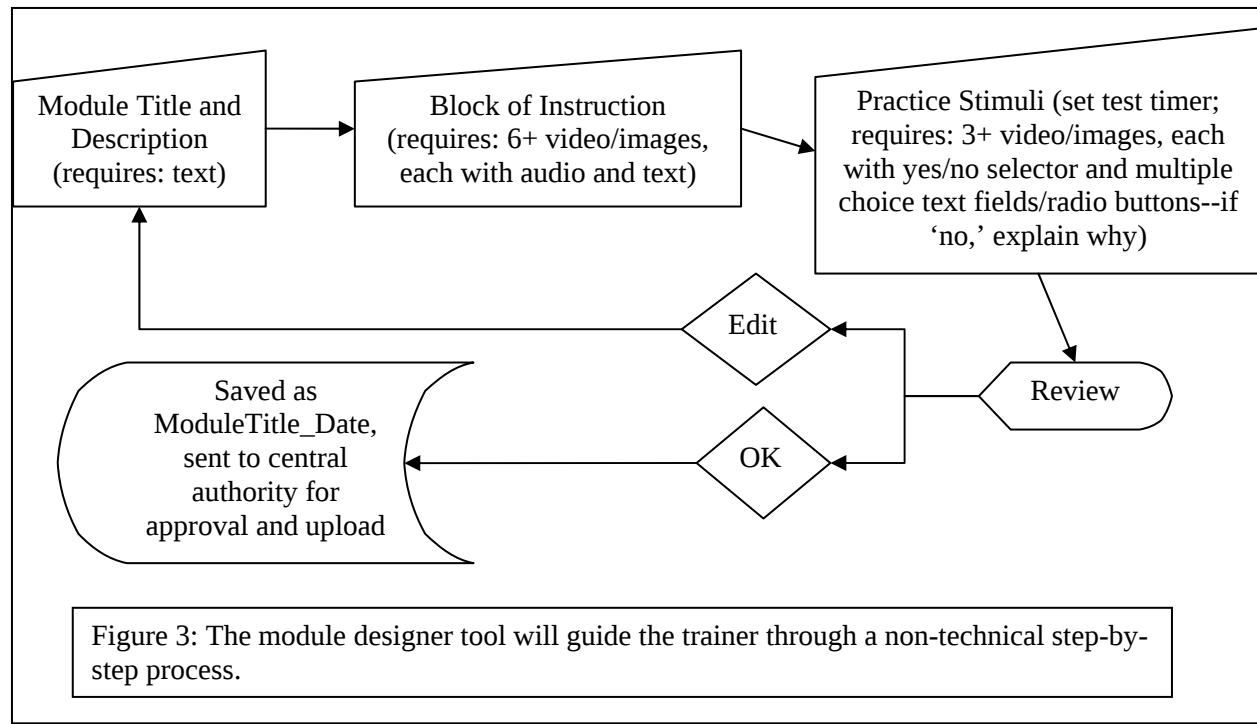
probability diagrams, psychological profiling, pattern analysis plot wheels and incident overlays to train and test advanced modules.

Functional Requirements

- a. Create and store user profile; requires AKO e-mail to register
- b. Display video, images and text
- c. Play audio files
- d. Show instruction screen before test starts, require user input to start test
- e. Properly handle user mouse/keyboard input for testing purposes
- f. Keep time for tests and cut-off inputs after time has expired
- g. Numerically grade tests ($\% = \text{Number Correct} / \text{Number Possible}$)
- h. Display score with “Review Answers,” Retest,” “Retrain” and “Different Module” options
- i. E-mails module description and the maximum score achieved to user’s AKO
- j. Show all modules available in the software
- k. Require modules are taken in order from easy to hard; disable “un-earned modules”
- l. Allow different module tracks for MOS-specific needs

Data Architecture

For the software to be continuously relevant, it is imperative that a software support suite allow non-technical personnel to design, upload and manage modules. This suite will consist of two components: the module designer and the administration tool. The module designer will walk an MOS trainer or unit leader through a step-by-step process to store the input of text, video, images and sound. The designer tool will store the module and notify the administrator that there is a new module for review. Modules will meet specific criteria and will require approval before final integration into the training software.



The administration tool will show all available modules along with a simple yes/no checkbox and comments for each module. If the module is not approved, the tool will send an automated message to the module designer with the comments in the body of the e-mail. The approval tool will also allow the authority to designate with a dropdown menu which MOS track(s) the module should show up in. The administration tool will also allow the authority to designate what order modules should fall in for each MOS track.

The centralized approval authority should consider the following criteria before uploading:

Multi-Functional. Students have different abilities to learn by hearing, seeing and reading. Blocks of instruction must have visual, aural and literal components in order to appeal to all trainees.

Unique. There isn't a module that already covers it, or the module will replace an outdated one (new IED TTPs, for example)

Thorough. There must be at least three demonstrations of the pattern prototype and three near-pattern demonstrations. Explanations of pattern criteria must be clear and detailed.

¹ Richards J. Heuer, Jr. "Psychology of Intelligence Analysis," *Center for the Study of Intelligence*, (CIA: 1999), 173.

² "Every Soldier is a Sensor" Video. [Online]. *U.S. Army Professional Video Collection* [Available at: http://www.army.mil/professionalvideo/movies/sensor_movie.html]. Accessed: 10 January 2009.

³ Carroll Thronesbery, B. Donald Sullivan & Ron Rhodes. "Pattern Recognition Training for Combat Leaders: Sample Training Package." *U.S. Army Research Institute for the Behavioral and Social Sciences*, (Ft. Leavenworth: Jan 1996), 1-2.

⁴ R.M. Gagne, *The Conditions of Learning (2nd Edition)*. (Dallas: Holt, Rinehart & Winston, 1970), 239.