The Johns Hopkins University
Applied Physics Laboratory
Laurel, Maryland 20723-6099

Final Technical Report

Grant Number: N00014-95-1-1119, User Modeling and Information Presentation for Naval Tactical Picture Agents

Period Covered: June 1, 1995, through May 31, 1996

Progress During Period:

The grant under which we performed this research began on June 1, 1995; the initial funding increment was received in July 1995. On December 20, 1995, we were informed of the termination of the Tactical Picture Agent Accelerated Capabilities Initiative (TPA ACI), under which this grant award was made, by Dr. Michael Shneier. After discussions and other communications with Dr. Helen Gigley that were aimed at restructuring our project within the funding limits of the initial increment, our grant was terminated on May 31, 1996.

The scientific tasks that were to be performed in this research project comprised a set of observational studies and a series of experiments. During the first year, observational studies were to focus on experienced naval tactical decision makers at sea and in the laboratory. We planned to make observations in conjunction with the at-sea evaluation of The Johns Hopkins University Applied Physics Laboratory's (JHU/APL) continuing series of operational prototypes for tactical information presentation systems [Buscher and Sunday, 1990; Grant, 1990] and with the laboratory evaluation of the next generation of such systems. Observations were to concentrate on the kinds of information sought and used by tactical decision makers and, in particular, what clues can be found in their decision-making and action-taking in the operational context to support dynamic assessment of their information needs. Initial laboratory studies would follow, using the data recording capabilities of existing JHU/APL tactical information systems, to investigate how such clues might also be found in records of the specific actions users take in employing such systems.

Our progress during the first several months of the one-year grant period was slowed by demands and deadlines of other projects. Those demands lessened by the end of the calendar year, after which we were available to devote more intensive effort to this project. However, after the cancellation of the TPA ACI in December, we were not able to reach agreement with ONR concerning the duration of availability of funds received in our original award or concerning the restructuring of our project, which was fundamentally dependent upon the duration of availability of funds. In the end, Dr. Gigley decided not to pursue our suggestions for restructuring the project because she had no way to continue the project beyond the additional months we requested. Consequently, rather than expend ONR's funds unproductively, we curtailed almost all of our planned work on the project. As a result, a substantial portion of our initial funding increment reverted to ONR.

Our primary effort during CY 1995 involved the following activities:

• Coordinating with JHU/APL staff who have contact with Navy personnel who could provide us with opportunities to observe major Fleet tactical exercises from the planning phases at shore facilities through tactical action phases aboard ships during the exercises themselves;

• Determining general tactical information requirements to be assessed during field observations and outlining the specific framework for cognitive models to be developed from those observations;

• Evaluating and selecting required data acquisition and analysis software and computer systems for field and laboratory use;

• Reviewing proposal information of other ONR TPA program participants posted to the ONR TPA Home Page on the World Wide Web;

• Preparing materials for our presentations to ONR TPA Workshops;

• Studying library and information science literature on identification, search, and retrieval of information from libraries, data bases, and similar repositories, especially that part of the literature dealing with associated cognitive organization and processing; and

• Reviewing Aegis Submode Review Interim Report (TI 9430 MM 248 Task 1D., 31 October 1994); identified therein the following CO and TAO activities on which to focus our initial research effort:

- Planning: Develop Doctrine
- Planning: Pre-Planned Responses
- Planning: Expected Event
- Fighting: Utilize Doctrine

The rationale for these choices was that the automated doctrine (response rules) entered by tactical users into a combat direction system can serve to relate users' information needs to their expected operational situations and planned actions. Our key observation was that the kind of information used (perhaps provided by tactical picture agents) in preparing preplanned responses can provide insight into essential elements of the operational situations that the users expect to encounter. These elements can then provide information (e.g., to other agents) about the users' decision-making context and about information elements' relevance and urgency. In addition, when such preplanned responses are embodied in response rules for automated systems, the information that they contain and use becomes readily accessible by agents and by research instrumentation.

We participated in two TPA ACI workshops: at Arlington, VA, August 9-12, 1995; and at the Navy Command, Control and Ocean Surveillance Center's RDT&E Division (NRaD) in San Diego, CA, November 28-30, 1995; our project's Navy

Laboratory assignment for coordination with 6.2-level programs was to the Naval Research Laboratory (NRL) in Washington, DC, with Mr. James Hofmann as our technical point of contact.

Our effort during CY 1996 was stymied by the sudden cancellation of the TPA ACI. After we learned of the cancellation, most of our effort was devoted to the following activities:

• Enhancing facilities of the JHU/APL-developed Combat Display and Control System, in which we planned to conduct portions of our interrupted investigation, to support tracking of user interactions with a naval tactical console in anticipation of recording user-system interactions for detailed analysis and user modeling [the CDCS is the prototype for the next-generation Aegis Display System (ADS Mk. 6), and provides a complete tactical picture to ship and warfare area command personnel];

The major thrust of this enhancement was the incorporation of context-sensitive pop-up menus to the CDCS tactical display. The tactical situation display of CDCS, like many Navy systems, includes many types of objects, for example:

- Air, surface, and subsurface vehicular tracks,
- Tactical zones and areas (including regions defining automated doctrine),
- Countries,
- Cities,
- Airfields,
- Airways,
- Roads.

In principle, additional information might be available about any of these objects from various sources. Such information might include, for example:

- Detailed sensor information used to make up a vehicular track
- Capability or intelligence information about a track
- Information about particular threats an automated doctrine zone is designed to counter
- Strike plans, news, political information, intelligence, weather relevant to a country or city

Tactical picture agents would presumably be tasked to search out and retrieve information that is reliable, recent, and relevant to the user's decision-making tasks. One way to make such information available to the user is by means of a mechanism in the user interface that indicates the available information that might be relevant to a particular object in the tactical situation display.

The CDCS tactical situation display, like most, supports the selection ("hooking") of vehicular tracks. When a track is selected, additional position, kinematic, identity, and sensor information is made available to the user through a text readout. In CDCS, all of the objects in the display are so selectable. We have

enhanced the display design so that selecting an object also presents a popup menu that lists additional information that may be relevant. The kinds of information are specific to the kind of object selected. For example, selecting a vehicular track presents options for viewing additional, detailed sensor information from each sensor that is contributing to that track. Selecting a country presents options for viewing strike plans, weather, or a live news feed about that country.

The menu structure is designed to be dynamically specified. While the choices indicated have defaults determined by the type of object selected, the software mechanism that presents the choices allows for them to be determined at the time the selection is made. This determination might be made by availability of particular information at that time. More significantly, it might be made by an agent's assessment of the user's decision-making context at that time.

We planned to begin using this capability to perform experiments designed to assess its usability and usefulness in a simulated tactical decision-making environment.

- Replanning, reorganizing, and rescheduling research activities in an effort to provide the sponsor with useful research results under a restructured project description; and

- Continuing the process of determining general tactical information requirements to be assessed during laboratory observations and outlining the specific framework for cognitive models to be developed from those observations.

Accomplishments

None beyond the initial steps described above.

References

Buscher, D. J., and Sunday, D. M. (1990). The Command Support At-Sea Experiment. *Naval Engineers Journal*, **102**(3), 25.

Grant, C. J. (1990). Aegis AAW Correlator/Tracker (AACT) Experiment. *Naval Engineers Journal*, **102**(3), 37.

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13. ABSTRACT *(Maximum 200 words)*

The grant under which we performed this research began in June 1995; the initial funding increment was received in July 1995. In December 1995 we were informed of the termination of the Tactical Picture Agent Accelerated Capabilities Initiative (TPA ACI), under which this grant award was made. After communications with ONR that were aimed at restructuring our project within the funding limits of the initial increment, our grant was terminated on May 31, 1996. Progress included: determining general tactical information requirements to be assessed during field observations and outlining the specific framework for cognitive models to be developed from those observations; evaluating and selecting data acquisition and analysis software and computer systems for field and laboratory use; studying library and information science literature on identification, search, and retrieval of information from libraries and data bases, especially as related to cognitive organization and processing; reviewing Aegis Submode Review Interim Report to identify CO and TAO activities on which to focus research effort; enhancing facilities of JHU/APL-developed Combat Display and Control System to support planned investigation, including incorporation of context-sensitive pop-up menus for tactically relevant objects; and preparing materials for two TPA ACI workshops.

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