

## Argus, a System for Varying Cognitive Workload

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Argus is a system developed to support research to understand and measure cognitive workload. It consists of a single-subject and a team version. Research with the single-subject version is concerned with cognitive workload from a dynamic micro-strategy perspective; the team version seeks to identify communication protocols and decision aids that support team performance under high workload conditions. Workload is varied by the experimenter through a set of authoring tools. In the single-subject version, multiple tasks, a decision task and/or a tracking task, multiple display interfaces and input modes further enhance the variability of task workload. In the team version, communication between team members is accomplished through text and data messages sent between workstations.

### OVERVIEW

Argus is a system developed to support research in the understanding and measuring of cognitive workload. Argus has a single-subject and team mode. In single-subject mode the main features are single or dual task execution with multiple interfaces, input modes and degrees of difficulty. In team mode it features communication between team members by text and data messages. Authoring tools provide flexible experimenter control over task cognitive workload.

The Argus software was developed to support the overall objectives of the Argus program, which are to develop highly correlated predictive and descriptive measures of cognitive workload in order to guide the design of novel interfaces for decision making tasks, and to measure workload during real-time task performance. Specifically in the single-subject version, Argus Prime, we are interested in dynamic micro-strategies and their impact on cognitive workload. In Team Argus we are interested in what levels of task workload are required to make the team's decision making process and performance deteriorate and what types of communication protocols and decision aids can facilitate team performance at high levels of task workload.

### FEATURES

The tasks available in Argus Prime are a scenario driven decision task, or a tracking task or both. Team Argus is solely a decision task. In the decision task, information is displayed to the subject about possible targets in the air space and on the ground. Based on this information and criteria given to the subject, he or she is to make a decision about what action to take (e.g., monitor, warn, engage etc.). In Team Argus access to the exact values of target attributes (cues) is distributed among the members. Members can send their cue data to other team members and can request data from other members. Text messages can also be sent among members.

In Argus Prime information is displayed either graphically on a radar screen with targets appearing as icons or the data is tabulated. Input can be via a pop-up menu or through an edit box in order to require typing.

Task complexity is a function of the scenario used as well as parameter settings. The number of targets, time of appearance, and the initial values of individual attributes are contained in the scenario. Parameters such as "show course" are used to manipulated task complexity.

Scoring is flexible and may be easily varied. Scoring is based upon all or a subset of the cues available for each target. The cues are assigned varying degrees of threat and weighted. The overall threat of a target is an additive combination of the selected cues. The final piece of the scoring mechanism is the mapping from the true score to a seven point decision scale. The subject accrues points when he or she makes a decision. Feedback may be provided to the subject as a percentage of the total points accrued divided by the total possible points.

In the tracking task (Argus Prime), target movement can be set to one of two levels of difficulty. The control provided by the joystick can be set to one of three levels of difficulty. The scoring is based on the root mean square error between the position of the target and the position of the pointing device.

A set of authoring tools is provided to the experimenter to create and edit scenarios, create a database of targets, and define the scoring and task complexity parameters.

Log files are created for each task. Currently under development is an interface to the eye tracking control unit which will transfer pupil diameter and eye gaze data.

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