

# Cognitive task load and support on a ship's bridge, the design and evaluation of a prototype user interface

In different work domains, such as defence and process control, the need for improved deployment of human knowledge and capacities is increasing. In addition to selection and training, adequate task allocation and computer support can provide the required improvement.

## Design of cognitive support

TNO Human Factors developed a method for cognitive task analysis for the Royal Netherlands Navy. This method is based on a cognitive task load model which describes task load in terms of three behavioural factors: *the percentage time occupied*, *the level of information processing* and *the number of task-set switches*. The higher the value of each factor, the higher the cognitive load. In the EU ATOMOS projects (Advanced Technology to Optimise Maritime Operational Safety), we applied this method for the design of user-interface support that reduces cognitive load. This resulted in an interface containing four support functions (Table 1): *an information handler* that pre-processes and integrates information, *a task scheduler* that provides an overall workplan, *a diagnosis guide* that guides diagnostic processes and *a rule provider* that provides normative procedures.

Table 1: Four support functions reducing cognitive load.

Load factor	Support function
Time occupied	Information handler
Level of info processing	Rule provider Diagnostic guide
Task-set switches	Scheduler

## Evaluation & Conclusions

The application of the method for cognitive task analysis was successfully for the ice-breaker domain. In an evaluation with 57 navy cadets, the support functions led to a substantial increase in effectiveness and efficiency, especially at high task load. We did not find negative “out-of-the-loop effects” of the support, like blindly following the advice or a decreased situation awareness. Currently, spring 2002, part of the support is being implemented on the bridge of an ice-breaker.

Contact: Dr. M.A. Neerincx  
TNO Human Factors  
Neerincx@tm.tno.nl

