
Chapter 8 – MILITARILY RELEVANT MENTAL OUTPUT MEASURES: WORKLOAD, SITUATION AWARENESS AND OTHER USEFUL CONCEPTS

Session Chair: Dr. Andy Belyavin

Centre for Human Sciences
A50 Building
Cody Technology Park
Ively Road, Farnborough
Hampshire GU14 0LX
UNITED KINGDOM

Presenter: Mr. Joe Armstrong

CAE Professional Services Inc.
1135 Innovation Drive
Suite 200
Kanata, Ontario K2K 3G7
CANADA

8.1 BACKGROUND

The interaction between cognition and context in the military environment is frequently summarised in terms of high-level constructs such as Cognitive Workload or Situational Awareness. By using these constructs it is possible to identify in qualitative terms the kind of corrective action that will improve crew performance and, in some cases, provide metrics that can be used to estimate the size of the improvement. The question arises as to whether it is useful to construct models of these high level constructs that can be used in conjunction with Human Behaviour Representations to support the same analysis.

There are two lines of argument that will serve as the basis for discussion. The first argument is that both workload and situational awareness have been developed as constructs because of the *lack* of understanding of basic cognitive processes and if there is an adequate model of cognition there is no need to consider these high level abstractions in the analysis of context. If this argument is accepted, the development of good quality cognitive models will eliminate the need to consider the high-level constructs and they will gradually fall into disuse.

The second argument is that these constructs provide a useful description of human performance in complex situations, providing a means to test and validate our models. If they fail to describe what we understand about workload, situational awareness and similar measures they are clearly not useful models. At the heart of this discussion is what do these output metrics measure and what is their utility in terms of modelling human behaviour.

8.2 DISCUSSION

8.2.1 Pleasing the Customer

It was clear from the discussion that some customers request output from models that is on the level of constructs such as workload or SA. It was argued, therefore, that human modellers should provide these

measures, otherwise someone else (likely without an appropriate human-sciences knowledge base) will do it, but will probably do it badly. Another point in favour of using these constructs is that subjects do report, or at least are able to report, experiencing things such as “workload”. Our models should therefore also generate such subjective responses.

It was argued that we could bypass the problems with these constructs if we would not use them as modelling concepts, but would generate these fuzzy constructs from the information present in the model. The main value in these concepts is as summary output measures that communicate aspects of performance to stakeholders.

8.2.2 Terminology

Most of those participating in the discussion agreed that many people outside of the Human Factors community use loose definitions of SA, viewing it as a concept solely related to sensors, data and displays rather than cognitive processes or knowledge state associated with understanding of the state of the immediate environment, as defined by Endsley and others. HBR modellers might therefore be better off using the term “sense making” instead, to distinguish SA from the technologies that support the acquisition of SA.

8.2.3 Containers

The general opinion was that these constructs are actually containers representing more complex and distributed phenomena. Workload could probably better be described as a collection of bottlenecks, instead of one big bottleneck. A similar argument holds for SA, since SA is probably a distributed (and somewhat fuzzy) collection of facts and interpretations of these facts that can not be localized or concretized.

It was argued that devoting energy to modelling these constructs to high fidelity is a poor investment of resources, since they are at best of limited use as modelling constructs. These constructs are therefore not to be used as a starting point of the modelling process but will evolve when “correctly” modelling performance (workload) and behaviour (SA).

8.3 CONCLUSION

Overall it was agreed that workload and SA are not useful as starting points for the modelling process. However, it was agreed that both measures should be derived from model outputs in a form that can be related to rigorously defined constructs, so that they can be presented to stakeholders in a way that communicates complex constructs clearly. No rigorous definitions were agreed within the session, although it was accepted that workload is a measure of the amount of task activity that has to be completed per unit time and Situation Awareness encompasses the human quality of understanding as expressed in a predictive mental model as well as the hard measure of what information is available.