Situation Awareness Global Assessment Technique (SAGAT)

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HP Activity Categories:
Assessment of situational awareness [1]
Resource Type:
Technique
Abstract:

The Situation Awareness Global Assessment Technique is a query technique that was developed by Endsley. SAGAT is based on information-processing theory. Endsley considers situation awareness as an internal model that is derived from the environment prior to decision-making and performance. SAGAT is one of the best publicized and most widely known measure of SA.

References

Developer and source:


General Description

Purpose:

SAGAT is a freeze on-line probe technique that allows the measurement of individual SA. It is designed for real-time, human in the loop simulations and provides diagnostic information regarding how well the system in question supports the operator’s various SA requirements, so it is a useful tool in design evaluation.

The simulation is frozen at randomly selected times and subjects are queried as to their perception of the situation at that instant. SAGAT queries are on specific data or data criteria corresponding to the three levels of SA (perception, comprehension and projection).

Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.):

Measurement instrument ? probing technique

Technical description of method or tool etc

Description of the content/study:

With SAGAT, mission or task simulations are frozen at randomly-selected times, the system displays are blanked and the simulation is suspended while subjects are queried as to their perception of the situation at that instant. The questions correspond to their situation awareness requirements as determined from the results of an SA requirements analysis. Operator perceptions are then compared to the real situation, based on simulation computer databases, to provide an objective measure of SA.

Multiple “snapshots” of operators’ SA are acquired in this way, which gives an index of the quality of SA provided by a particular design. The collection of SA data via SAGAT provides an objective, unbiased assessment of SA that overcomes the problems incurred from post-hoc assessments.

As a global measurement tool, SAGAT includes queries about all operator SA requirements, including level
1 (perception of data), level 2 (comprehension of meaning) and level 3 (projection of the near future) components. This includes a consideration of system functioning and status as well as relevant features of the external environment. By including queries across the full spectrum of an operator’s SA requirements, this approach minimizes the possible bias of attention, as subjects cannot prepare for the queries in advance.

Technical requirements for using the method, tool, etc:

Requires simulation platform.

Typically, a high fidelity simulation of the task under analysis and computers with the ability to generate and score SAGAT queries are required. The simulation and computer used should possess the ability to randomly blank all operator displays and ‘window’ displays, randomly administer relevant SA queries, and calculate participant SA scores.

Measure/Response Type:

SAGAT provides an objective measure of SA based on queries during freezes in a simulation. Queries are determined based on in depth cognitive task analysis that must be conducted for each domain SAGAT is use in.

Participant’s answers will be compared with ‘ground truth’ information recorded by the simulation computer system at the time of each stop (or by comparison with expert experimenter responses to the same SA queries). The responses are scored, as correct or incorrect. Questions asked, but not answered, are considered incorrect. All aircraft are considered equivalent.

Answers are compared to the data collected in the system at the same point in time. The data collected correspond to the three levels of SA depicted in Endsley’s Model (perception, comprehension and projection).

Results obtained and interpretation:

SAGAT results provide diagnostic information that indicate ways in which a given design concept improves SA and ways in which it diminishes SA. These results can then be used to refine the design concepts.

High SA in SAGAT means that the situation and the subjective image of the situation match to a high degree. (Jeannot et al., 2003)

Evaluation

Advantages:

SAGAT is a particularly useful technique in design evaluation because it provides diagnostic information regarding how well the system in question supports the operator’s various SA requirements.

Provides broad, ‘global’ testing of SA in a direct approach manner.

Recognises the need for a comprehensive assessment of operator SA requirements for the design of the queries.

Removes problems associated with collecting SA data post-trial.

Provides quantitative results.
Possibility to compare with similar data in similar context (Jeannot et al., 2003)

Avoids problems collecting data post trial (Stanton et al., 2005).

Disadvantages:

Disruptive simulation halts causes interruption of the natural flow of the task.

All queried items (e.g. location & status of aircraft) are considered equal.

Does not take into account the principle of operational distortion: controllers change (unconsciously) some aspect of reality to make it easier to work.

Subject to memory decay and inaccurate beliefs.

Requires expensive simulators (Salmon et al., 2006). Requires the capability to pause the simulation.

Cannot be applied “in-the-field” or in real-time.

Analysis requires extensive preparation (Stanton et al., 2005).

Low sensitivity.

Intrusive to primary task.

Alternative Methods:

SART

SPAM

Usability (ease of use, efficiency, effectiveness)

Ease of use:
medium

Efficiency:
medium

Effectiveness:
low

Constraints concerning conditions of use:

The technique is best suited for measurement of individual SA in real-time, human in the loop simulations.

Sufficient time needed. Queries must be predetermined. Questions may be programmed to appear on the user’s screen and entered dynamically, or verbally queried by a researcher. Not suited to the assessment of team SA (Stanton et al., 2005)

Reliability:

Endsley (2000) reports that the SAGAT technique has been shown to have a high degree of validity and reliability for measuring SA.

SAGAT has been shown to have a high degree of reliability (e.g., Endsley & Boldstad (1994), to possess sensitivity to condition manipulations (Endsley, 2000), and to be effective across a variety of domains,
including air traffic control (Endsley, Sollenberger, Nakata, & Stein, 2000); commercial aviation (Endsley & Kiris, 1995; Kaber, Endsley, Wright, & Warren, 2002); and teleoperations (Kaber, Onal & Endsley, 2000).

According to Endsley (2000) a study found SAGAT to have high reliability (test-retest scores of .98, .99, .99 and .92).

Despite the numerous studies that have been conducted over a wide range of application areas, the validity of the technique remains debatable. For example, in a comparative simulation study (Endsley et al., 2000), SAGAT was found to be no better than SART or a SPAM-like probe technique. (Jeannot et al., 2003)

Validity:

Along with the SART technique, SAGAT is the most widely validated of all SA techniques. According to Jones and Kaber (2004) numerous studies have been performed to assess the validity of the SAGAT and the evidence suggests that the method is a valid metric of SA.

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Required effort (to conduct & to analyse):

Amount of efforts: Medium Effort

Level of HF expertise needed (required user qualification)

HF specialist needed for using the technique

High: high level of expertise required, only for experts, lots of training required
Other expertise needed (required user qualification):

Simulation environment required, therefore the personnel to set-up, maintain and run such environment is essential.

Operational knowledge of the tasks under analysis required to create the query questions.

Cost Information

n/a

Experiences of use by SESAR partners (including references):


Reported and/or published experiences of use (including references):
A lot of study have been conducted on SAGAT, here the key studies: Endsley, 1999; Endsley & Kaber, 1999; Endsley & Rodgers, 1998; Endsley, Sollenberger, & Stein, 2000; Hilburn, 2000; Kaber & Endsley, 2004; Kaber et al., 2006; McClernon et al., 2006; Nunes, 2003; O?Brien & O?Hare, 2007; Salmon et al., 2006.


Applicability to lifecycle phase (E-OCVM):
V2, V3

Application Area:
Studies have been conducted with SAGAT over a wide range of application areas for fighter aircraft, bomber a/c, commercial a/c, air traffic control, maintenance systems, nuclear power.

Keywords:
Situation Awareness, Measurement, Air Traffic Control, Simulation, Aviation

Short Description:
SAGAT is a query technique that was developed by Mica Endsley. It is based on a freeze on-line probe technique and is designed for real-time, human in the loop simulations. The simulation is frozen at randomly selected times and subjects are queried as to their perception of the situation at that instant. SAGAT queries are on specific data or data criteria corresponding to the three levels of SA (perception, comprehension and projection).

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