Situation Awareness Rating Technique (SART)

Submitted by superadmin on Mon, 10/22/2012 - 14:45

HP Activity Categories:
Assessment of situational awareness

Resource Type:
Technique

Abstract:

The situation awareness rating technique (SART) (Taylor 1990) is a simplistic post-trial subjective rating technique that was originally developed for the assessment of pilot SA. SART uses the following ten dimensions to measure operator SA: Familiarity of the situation, focussing of attention, information quantity, information quality, instability of the situation, concentration of attention, complexity of the situation, variability of the situation, arousal, and spare mental capacity.

SART is administered post trial and involves participants subjectively rating each dimension on a seven point rating scale (1 = Low, 7 = High) based on their performance of the task under analysis. The ratings are then combined in order to calculate a measure of participant SA. A quicker version of the SART approach also exists, known as the 3D SART. The 3D SART uses the 10 dimensions described above grouped into the following three dimensions:

(1) demands on attentional resources,
(2) supply of attentional resources, and
(3) understanding of the situation.

References

Developer and source:


Year of development / publication, updates etc:

1989, 1990
General Description

Purpose:

SART is a self rating technique which elicits the subjective opinion on how aware a person was during task performance.

The reason that SART measures different components is that the SART developers feel that, similar to workload, SA is a complex construct; therefore, to measure SA in all its aspects, separate measurement dimensions are required. Because information processing and decision making are inextricably bound with SA (because SA involves primarily cognitive rather than physical workload), SART has been tested in the context of Rasmussen’s Model of skill-, rule-, and knowledge-based behaviour.

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

Questionnaire

Technical description of method or tool etc

Description of the content/study:

SART is a multidimensional scaling technique that consists of a series of questions that have bipolar responses. The number of dimensions varies between different SART forms. In its original form there are ten dimensions. It is administered post trial and involves participants subjectively rating each dimension on a seven point rating scale (1 = Low, 7 = High) based on their performance of the task under analysis. The ratings are then combined in order to calculate a measure of participant SA.

The original SART uses the following ten dimensions (construct) to measure operator SA:
The ten SART dimensions can also be condensed into the quicker version of the SART, known as the 3D SART. The 3D SART uses the 10 dimensions described above grouped into the following three dimensions:

(1) demands on attentional resources (complexity, variability, and instability of the situation),

(2) supply of attentional resources (division of attention, arousal, concentration, and spare mental capacity), and

(3) understanding of the situation (information quantity, and information quality).

Technical requirements for using the method, tool, etc:

None, SART is applied using pen and paper only. However, it can also be administered using Microsoft Excel, which can also be used to automate the SART score calculation process.

Measure/Response Type:

SART is administered post-trial and involves the participant rating of each of the 10 dimensions on a seven point rating scale (1 = Low, 7 = High, see figure below). The ratings are then combined in order to calculate a measure of participant SA.

A composite SART score is calculated using the following formula: \( SA = U - (D - S) \), where:

\( U = \) summed understanding

\( D = \) summed demand

<table>
<thead>
<tr>
<th>Domains</th>
<th>Construct</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attentional demand</td>
<td>Instability of situation</td>
<td>Likelihood of situation to change suddenly</td>
</tr>
<tr>
<td></td>
<td>Variability of situation</td>
<td>Number of variables that require attention</td>
</tr>
<tr>
<td></td>
<td>Complexity of situation</td>
<td>Degree of complication of situation</td>
</tr>
<tr>
<td>Attentional supply</td>
<td>Arousal</td>
<td>Degree that one is ready for activity</td>
</tr>
<tr>
<td></td>
<td>Spare mental capacity</td>
<td>Amount of mental ability available for new variables</td>
</tr>
<tr>
<td></td>
<td>Concentration</td>
<td>Degree that one’s thoughts are brought to bear on the situation</td>
</tr>
<tr>
<td></td>
<td>Division of attention</td>
<td>Amount of division of attention in the situation</td>
</tr>
<tr>
<td>Understanding</td>
<td>Information quantity</td>
<td>Amount of knowledge received and understood</td>
</tr>
<tr>
<td></td>
<td>Information quality</td>
<td>Degree of goodness of value of knowledge communicated</td>
</tr>
<tr>
<td></td>
<td>Familiarity</td>
<td>Degree of acquaintance with situation experience</td>
</tr>
</tbody>
</table>
S = summed supply

The quicker 3-D SART uses a 100-point scale from 0 (low) to 100 (high), for each measure (demand on attentional resources, supply of attentional resources and understanding of the situation). The overall SART score is then calculated similar to above:

\[ SA = \text{Understanding} - (\text{Demand} - \text{Supply}) \]

Results obtained and interpretation:

The result consists of a composite score of SA.

**Evaluation**

Advantages:
Quick and easy to administer, requires very little training. Also low cost.
Generic – can be used in other domains.
Applicability to multiple domains.
High ecological validity.
A certain level of diagnosticity.
Accounts for attentional supply and demand.
Self-ratings of SA can be obtained from different team members and so offer a potential approach into the assessment of team SA.
SART is non-intrusive to task performance.
SART is a widely used method and has been applied in a range of different domains.
It provides a quantitative assessment of SA.

Disadvantages:
Problems of gathering SA data post-trial e.g. correlation with performance, i.e. participants may be prone to ‘forgetting’ periods of the task when they possessed a poor level of SA, and may more readily remember the periods when they possessed a superior level of SA.
Issues regarding sensitivity of the technique. Participants’ ability to rate their own SA is questionable, regarding whether or not participants can accurately rate their own awareness (e.g., how can one be aware that they are not aware?).

Potential influence of workload.

Data collection post task has some problems associated, including memory degradation and poor recall.

SART has performed poorly in a number of SA methodology comparison studies (e.g., Endsley, Sollenberger, and Stein, 2000; Endsley, Selcon, Hardiman, and Croft, 1998; Salmon et al., 2009).

Alternative Methods:

SASHA, SAGAT.

SART is a questionnaire-based methodology and is one of many subjective rating SA measurement approaches.

**Usability (ease of use, efficiency, effectiveness)**

Easy to use and administer.

Ease of use:
- high

Efficiency:
- high

Effectiveness:
- medium

Constraints concerning conditions of use:

none

Reliability:

According to Jones (2000), numerous studies have been performed to examine the validity of SART. Strong claims are made for the validity and sensitivity of the scale constructs, and the diagnostic capability of SART, but the evidence remains weak at best. In a recent empirical ATC simulation study comparing three SA measures, SART was found not to be sensitive to the display manipulation [Endsley, M. R. (2000). Direct measurement of situation awareness: Validity and use of SAGAT. In M. R. Endsley & D. J. Garland (Eds.), "Situation Awareness Analysis and Measurement" (pp. 147-173). Mahwah: Lawrence Erlbaum Assoc.].


Validity:
According to Jones and Kaber (2004) [Jones, D.G., and Kaber, D.B., 2004. In N. Stanton, Hedge, Hendrick, K. Brookhuis, E. Salas (Eds.) Handbook of Human Factors and Ergonomics Methods. Boca Raton, USA, CRC Press.] 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.

In other validation studies, the SAGAT (freeze probe) technique has proved to be superior in terms of reliability, validity and sensitivity when compared to the SART (self-rating) technique.


Required effort (to conduct & to analyse):

The data obtained is easily and quickly analysed and reported.

The training and application times associated with the SART method are very low. As it is a self-rating questionnaire, there is very little training involved. The SART questionnaire takes no longer than 5 minutes to complete, and it is possible to set up programmes (e.g. Excel) that auto-calculate SART scores based on raw data entry.

Level of HF expertise needed (required user qualification)

Medium: limited level of expertise required, some training required
Other expertise needed (required user qualification):

none

Cost Information

No information available

Experiences of use by SESAR partners (including references):

n/a

Reported and/or published experiences of use (including references):


Last accessed 5/6/2011

http://books.google.co.uk/books?hl=en&lr=&id=akMk8TVFP2cC&oi=fnd&pg=PA16... [2] Situational+Awareness+Rating+Technique%22&ots=kV_ALhfex3&sig=fBXO_6FFZ4oH-hhaS9ijnj5BLswE#v=onepage&q=Taylor%201989%20%20Situational%20Awareness%20Rating%20Technique%22&f=false

Applicability to lifecycle phase (E-OCVM):
Suitable for EOCVM V3

Application Area:

The SART approach was originally developed for use in the military aviation domain; however, it has since been applied in various domains, and since the SART dimensions are generic it is feasible that it could be used in any domain to assess operator SA.

Keywords:

Situation awareness, Situational awareness, ATC

Short Description:

SART is a post-trial subjective rating technique that was originally developed for the assessment of pilot SA. It uses ten dimensions to measure operator SA and participants are rating each dimension on a seven point rating scale.

Source URL: http://webprisme.cfmu.eurocontrol.int/ehp/?q=node/1608

Links