Goal-Directed Task Analysis (GDTA)

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HP Activity Categories:
Assessment of situational awareness [1]

Resource Type:
Technique

Abstract:

GDTA is a cognitive task analysis technique developed by Endsley that is concerned with the situation awareness requirements necessary to complete a task. GDTA seeks to document the information needed by users to perform their tasks and how this information is integrated to address a particular decision (Endsley, 2003)

References

Developer and source:


Endsley, M. R. & Rodgers, M. D. Situation Awareness Information Requirements for En Route Air Traffic Control. U.S. Department of Transportation, Federal Aviation Administration: 1994. GDTA is used in the air traffic control domain.


Year of development / publication, updates etc:

General Description

Purpose:

GDTA consists of structured interviews, observations of operators performing their tasks, as well as detailed analysis of documentation on users? tasks are used to complete the analysis process. A GDTA will reveal information needs for complex decision making in environments such as air traffic control. By following the methodology of the Goal Directed Cognitive Task Analysis (GDTA), a hierarchy of goals, decisions and related information requirements is developed. The GDTA has been employed broadly for analyzing SA requirements of individuals (Endsley, 1993; Endsley and Rodgers, 1994).

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

Interview, Observation

Technical description of method or tool etc

Description of the content/study:

Goal-directed task analysis is an information requirements assessment technique developed by Endsley (1993, 1995) and originally demonstrated in the aviation domain. The knowledge obtained through the GDTA can help designers to design systems, which enhance situation awareness leading to better decision-making and process performance. GDTA focuses on identifying operator perception, comprehension and projection requirements in performing complex systems control. The results of a GDTA include lists of goals, critical operator decisions and SA requirements that can be used as a basis for defining appropriate content of complex system information displays, as well as for training program development, development of SA assessment measures, and operator selection.

The general steps to conducting a GDTA include identifying the users? major goals, identifying sub-goals to support overarching goals, identifying operational tasks to achieve the sub-goals, identifying questions as part of decision-making in task performance, and developing information requirements to answer these questions (Usher and Kaber, 2000). This information is elicited from a domain expert in structured interviews.

The experts are typically presented with a task scenario and asked to mentally place themselves in the situation and to describe performance in the absence of any existing automated support systems. The analyst then creates a goal tree (or outline) describing the information requirements, independent of the technology that may ordinarily be used. The analysis is based upon operator goal states in the scenario and not on specific states of the task environment or support systems.

For these reasons, GDTA is a good tool for supporting new systems designs to facilitate operator manual control. These features of the GDTA also limit its potential for specifying design requirements for existing interfaces, since the interface itself is not characterized as part of the analysis.

The steps involved in the GDTA interview are as follows (Endsley et al., 2003):

1. Identification of key decision makers: the key decision makers who are playing the significant role should be chosen for applying the GDTA methodology.
2. Identification of major goals and associated sub-goals for each decision maker: each decision maker should be asked about his/her main goal.
3. Identification of the primary decision needed for each sub-goal: each decision maker should be enquired about the sub goals, which are necessary to accomplish the main goal.
4. Identification of the SA information requirements for making those decisions and performing each sub-goal: The sub goals would serve to set the direction for clarifying the primary decision needed for each
sub-goal and the information needs to accomplish those sub goals.

The information obtained from the GDTA is organized into figures depicting a hierarchy of the three main components of the GDTA (i.e., goals/sub goals, decisions relevant to each sub goal, and the associated SA requirements for each decision).

Technical requirements for using the method, tool, etc:

Paper & pencil.

Measure/Response Type:

n/a

Results obtained and interpretation:

The GDTA-based interviews conducted with facility management SMEs provided the necessary information for developing the goal hierarchies and related SA requirements. By combining these hierarchies, a unique hierarchy of goals for the facility managers was achieved.

**Evaluation**

Advantages:

It is not tied to the technology being used to carry out the task (i.e., it is independent of how tasks are done within a given system but it depends on what information is needed);

It does not just focus on people's data needs, but on how the said data can be used within decision making and the goal attainment process;

It focuses on obtaining an accurate depiction of the SA requirements and key goals for each individual (Strater, Endsley, Pleban, and Mathews, 2001; Bostald et al., 2002 - Cited in Gheisari & Irizarry, 2011).

Disadvantages:

GDTA modeling requires significant time investments on the part of analysts and SMEs (Kaber et al., 2006).

Alternative Methods:

GOMS - Goals, operators, methods, selection rules

CDM - Critical Decision Method

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

<n/a/>

Constraints concerning conditions of use:

The GDTA is well suited to complex, dynamic tasks (Kaber et al., 2006). For managing high workload (time stress, dynamic environment); for achieving and maintaining high SA.

Reliability:
Validity:

n/a

Required effort (to conduct & to analyse):

High effort is required.

**Level of HF expertise needed (required user qualification)**

SMEs and HF specialist needed for using the technique.

High: high level of expertise required, only for experts, lots of training required

**Cost Information**

n/a

Experiences of use by SESAR partners (including references):

n/a

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


Applicability to lifecycle phase (E-OCVM):

V2-V3

Application Area:

GDTA has been applied in various domains including healthcare (Wright et al., 2004), military (Jones et al., 2003), and power transmission and distribution industry (Connors et al., 2007). More recently, the GDTA was used to develop a protocol (Goal Directed Information Analysis) to identify information requirements of emergency first responders in the fire and rescue service (Prasanna et al., 2009, cited in Abd Hamid & Waterson, 2010).

Moreover in Pre-hospital care Domain (Abd Hamid & Waterson, 2010) and in facility management domain (Gheisari & Irizarry 2011).

Keywords:

Cognitive task analysis, Goal-directed task analysis, Abstraction hierarchy, Human–machine interface design, Situation Awareness (SA), Decision-making, Facility Management (FM), human factors, Situation Awareness (SA)

Short Description:
GDTA is a cognitive task analysis technique developed by Mica Endsley that is concerned with the situation awareness requirements necessary to complete a task. It consists of structured interviews, observations of operators performing their tasks and detailed analysis of documentation on users' tasks. A GDTA will reveal information needed by users to perform their tasks in complex decision making in environments such as air traffic control and how this information is integrated to address a particular decision.

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