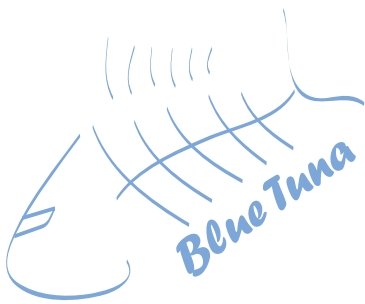




Human Factors

Situational Awareness

Working Definitions

Situational Awareness ...

... refers to the degree of accuracy by which one's perception of his current environment mirrors reality.

... relates to maintaining a collective awareness (or consciousness) of important job related conditions and events.

... is the ability to identify, process and comprehend the critical elements of information about what is happening to the team with regards to the mission.

More simply, it's knowing what is going on around you.

Situation Awareness may be described as "the perception of the elements in the environment with a volume of time and space, the comprehension of their meaning and the projection of their status in the near future." A critical part of SA is understanding how much time is available until some event occurs or action must be taken. The perception of space (how far away an element is) and how soon the element will have an impact, plays an important role in SA.

Level 1 SA Perception Perception of cues is primary. Without basic perception of important info, the odds of forming an incorrect picture of the situation increases. (76% of SA errors occurs here)

Level 2 SA Comprehension As a construct SA goes beyond perception. It includes how people combine, interpret, store and retain information. More than perceiving or attending to info, it includes integration of multiple pieces of info and determination of their relevance.

Level 3 SA Projection The highest level of SA is the ability to forecast future situation events and dynamics. This marks operators with the highest level of understanding the situation. This is the mark of a skilled expert.

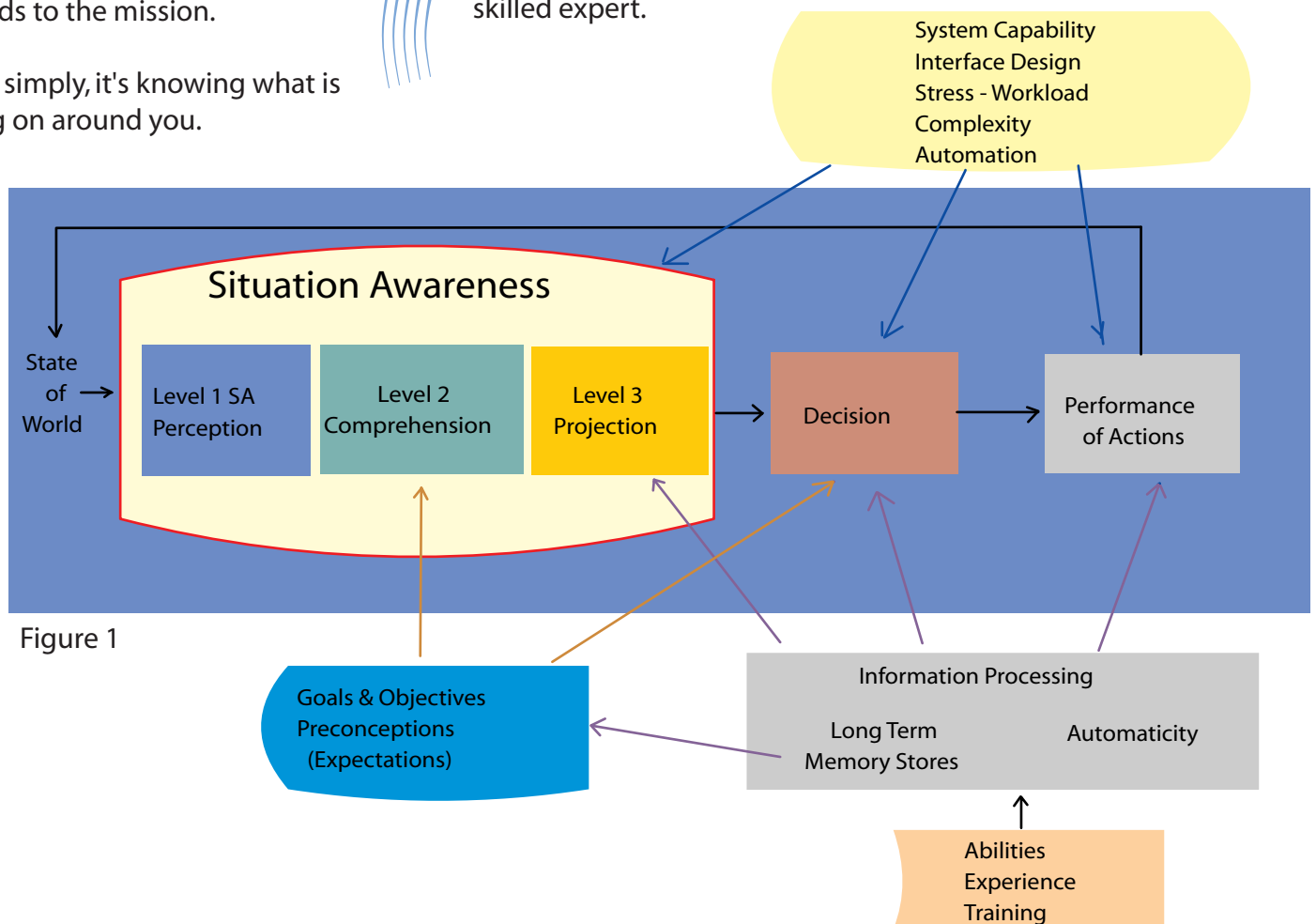


Figure 1

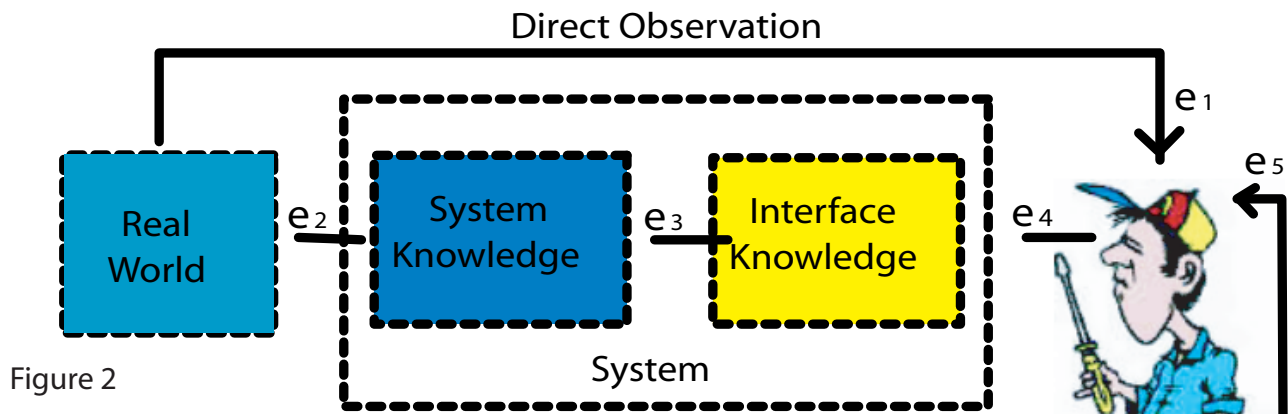


Figure 2

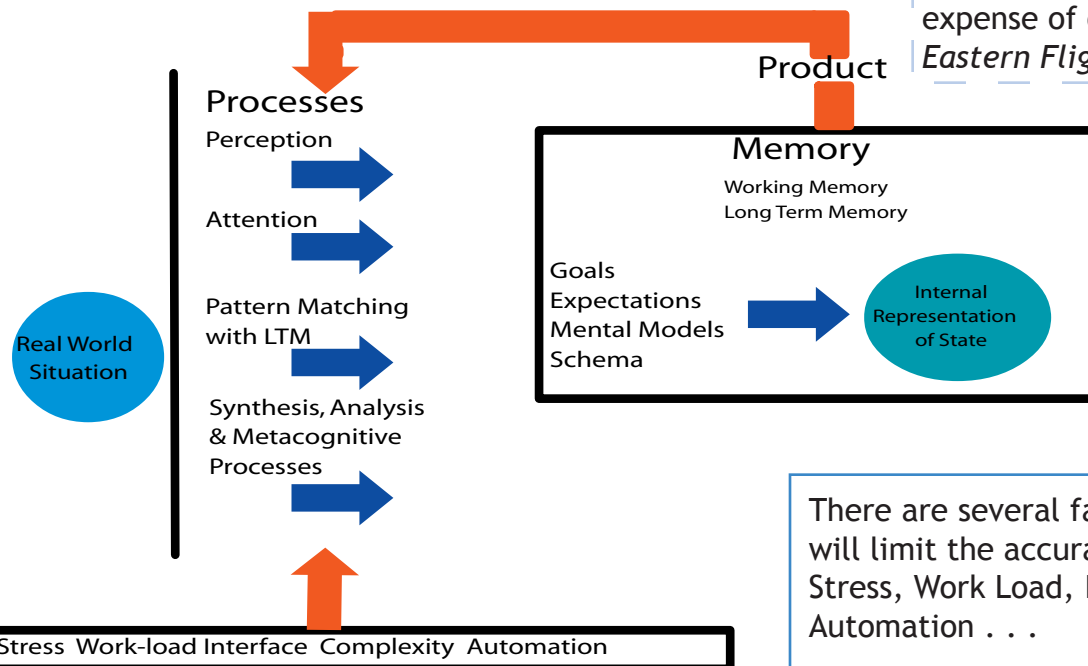
How do we get Situational Awareness?

Cues are derived from the world through our senses. The cues may be overt and some are quite subtle. Systems are added to aid operators. System interfaces may be things like test equipment, interfaces for remote work like flying an unmanned aircraft. Team members play an important role in this process. Both verbal and non-verbal communication are important sources of information for SA.

Team Members and Others

Working memory and attention are limitations. Numerous cues compete for attention. Goal states, and other bits of info make heavy demands on working memory. Operators prioritize info, but even operators can err in this process neglecting to attend to certain info over other info. **35% of total SA errors** occur where all the needed info was present, but not attended to by the operator.

Endsley 1988; 1990b; 1995c;



Attention Narrowing is the process of tunneling one's attention at the expense of other important data. *Eastern Flight 401 problem . . .*

There are several factors represented here that will limit the accuracy and completeness of SA. Stress, Work Load, Interface, Complexity, Automation . . .

Figure 3

Mental Models

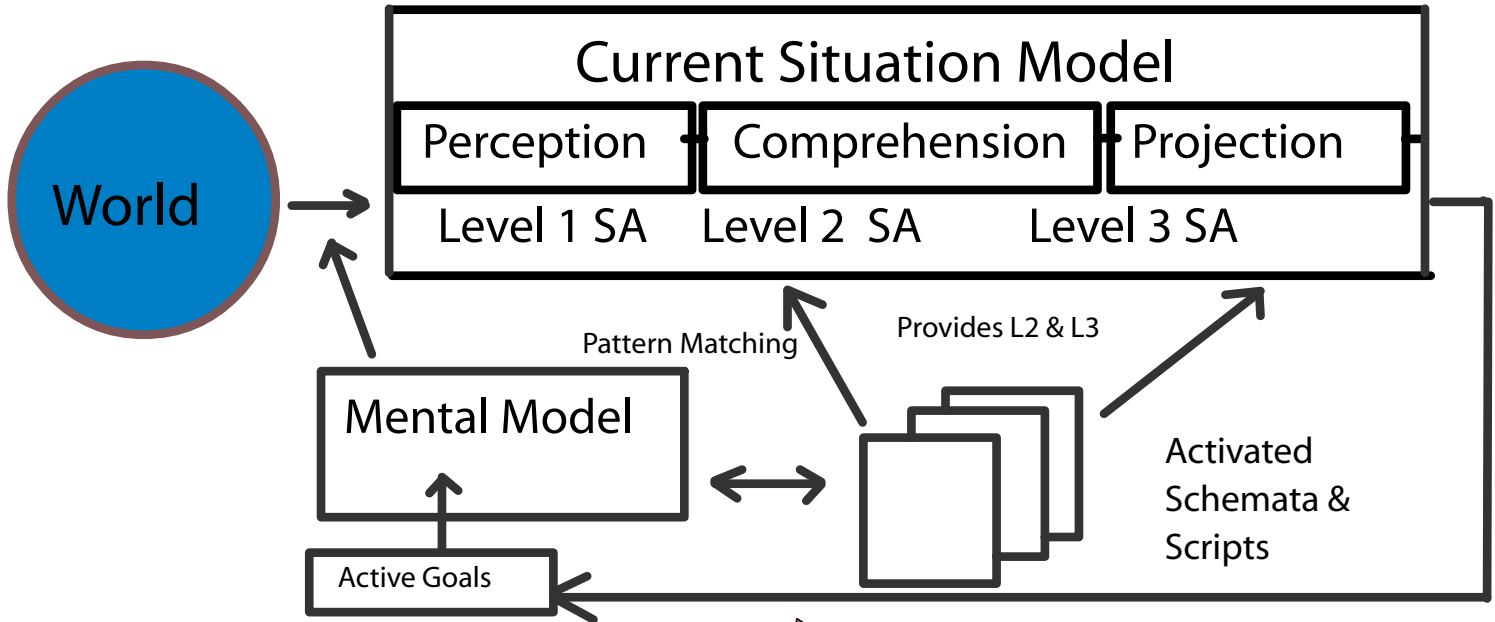


Figure 4

Long term memory stores in the form of **mental models** or **schema** plays a major role in dealing with the limitations of working memory.

Mental Models and Schema Explained ...

Mental Models is our internal pictures of the world. These pictures of the world shape our actions and decisions.

Schema are scripts, these are segments of Mental Models. In other words Mental Models are constructed from Schema.

Schema can be used not only to interpret but also to predict situations occurring in our environment.

How It Works

Mental Models are efficient in that they do not load working memory.

Pattern matching helps to identify classes or snapshots of info in the SA process.

Goals acts as filters for interpreting information providing validity for what is projected.

The Role of Goals

1. Active goals direct the selection of the particular Mental Model.
2. The goal and its associated mental model are used to direct attention in selecting information from the environment. The Goal and Mental Model scans patterns and info from the environment. A problem arises when goals change. Subtle changes in the environment should result in shuffling goals. This is a data driven model, where a given change in a situation triggers the selection of a new goal.

Endsley sums it up ... "They furthermore point-out that SA is therefore dependent on a normative definition of task performance and goals that are appropriate in the specific environment.

The Dangers of Working in the Autopilot Mode ...

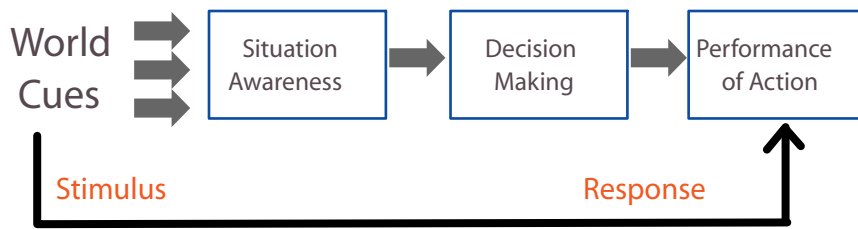


Figure 5

Automaticity

Problems with Automaticity

1. . . . does not allow for novel integration of information
2. . . . people under automaticity tend to be non receptive to novel events
3. . . . errors tend to occur when there must be a change in the learned pattern



Situational Awareness in the Workplace

Training in the workplace . . . or scripting in work related tasks impacts the long term memory (LTM).

The value of saturating LTM should not be underestimated, especially when there are tasks with high degrees of complexity.

Good SA is dependent on a normative definition of tasks and goals that are appropriate in a specific environment. This approach takes into account data and goals important in accomplishing the tasks at hand. Solid course design must take this input into consideration.

Promote good team situational awareness begins with . . .

1. Verbalization of Decisions
2. Better Team Meetings
3. Teamwork and Feedback
4. Individual ST Training
5. Shared Mental Models

Everyone slips off into the autopilot mode at work . . . every now and then.

SA is directly impacted when a worker slips off into the autopilot mode.

Routine sequences tend to lead to the autopilot mode, SA is not attended to, in fact the whole process is short circuited . . . this is Automaticity.

While Situational Awareness should lead directly to selection of an appropriate action from memory - it does not always happen this way.

Individuals still can make poor decisions with good SA.

In the design processes for production and maintenance - checklists, double inspections and recursive procedures may to a long way towards ensuring good decisions are made.

Attention tunneling, lack of attention and Stress in the workplace impact SA, especially where multiple sources of info compete for attention and also, where there is a high degree of complexity.

Design changes in work procedures and work loads can influence the distribution of attention in an appropriate and manageable way.

Stress impacts a person's ability to process SA at all levels (L1-L3). This is especially true when time and space are critical factors in the flow of the work processes.

Stress as a human factor has a cascading effect on memory, recall and the act of actually making a decision.