Dynamic Situations: The Soldier's Situation Awareness

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The role of the Soldier is not as strictly defined today, as it was in World War II. In place of battlefields, the Soldier is placed in roles from peace keeper to combat Soldier in collapsed first world counties to impoverished third world nations. This fogs the understanding of situations and the role the Soldier is to play in them. Within these changing and dynamic times, a Soldier's situation awareness has become vitally important. Understanding who are combatants, civilians, and allied personnel, as well as, knowing the rules of engagement for the given situation, are all part of Soldiers' situation awareness.

1.0 SITUATION AWARENESS

Researchers over the last two decades have continued to narrow the definition of situation awareness and apply its concepts to different circumstances and personnel. The term situation awareness (SA) has been used with pilots, air traffic controllers, fire fighters, and others who are involved in situations that require quick decisions under stress [11].

A popular definition of situation awareness, offered by Endsley [7], is perception of the elements in the environment within a volume of space and time, the comprehension of their meaning, and the projection of their status in the near future. This was simplified by Howell [14] to read SA involves an operator keeping track of a lot of information from a variety of sources over time and organizing or interpreting this information. Later, Endsley [6] expanded her definition into a model of situation awareness including three levels. The first is a perception of the elements of the current situation. This is an understanding of the physical environment a person is in. The second is a comprehension of the situation. Here the dynamics of the physical elements and people in the situation must be understood, in terms of their movement and purpose. Third, is the projection of future status of the situation. Situation awareness occurs over time; therefore, the effect on current events on the near future is the last level of this definition of situation awareness. SA encompasses not only an awareness of key elements in the situation, it encompasses a gestalt ('big picture') comprehension and integration of that information in light of operational goals, along with the ability to project future states of the system. These higher levels of SA, gestalt understanding of the situation and future prediction, have been found to critical to effective functioning in complex environments, such as those faced by Soldiers [7]. Furthermore, situation awareness, according to the U.S. Army Training and Doctrine Command (TRADOC), is defined as "the ability to have accurate real-time information of friendly, enemy, neutral, and non-combatant locations; a common, relevant picture of the battlefield scaled to specific levels of interest and special needs." This final definition is pertinent to all Soldiers on all battlefields.

2.0 SA AND DECISION MAKING

With an understanding of the Soldiers current situation awareness, application of SA in decision making becomes vital. In order to make good decisions in the combat environment it is necessary to make an accurate assessment of the situation [32].

An area of current research that implements SA in decision making is naturalistic decision making [28, 18]. The Soldier in the field must be prepared to make split-second decisions that could save or lose lives.

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One method of planning for split-second decision making is recognition-primed decisions (RPDs). Klein, Calderwood, and Clinton-Cirocco [20] presented the recognition-primed decision model that describes how decision makers can recognize a plausible course of action (COA) as the first one to consider. A commander's knowledge, training, and experience generally help in correctly assessing a situation and developing and mentally war-gaming a plausible COA, rather than taking time to deliberately and methodically contrast it with alternatives using a common set of abstract evaluation dimension. RPDs are hypothesized to work well in naturalistic decision making which encompasses environments with time constraints, changing conditions, and stress, [19]. The findings of RPDs and the ability to make better decisions with RPDs was based, in part, on better situation awareness. Researchers in this area have found that skilled decision-makers usually make a good COA on the first try and that if they change to a secondary choice it is usually not as good as their first choice [22, 16].

In a similar study, Kaempf, Klein, Thordsen, and Wolf [17] investigated how SA influences decision making in a Navy Combat Information Center (CIC) and found that SA is an important factor in decision quality. Furthermore, fluidity of the situations and the incompleteness of available information ensure that the problems attacked by natural decision making are inherently ill-defined [21] which is the exact environment that today's Soldiers find themselves in. RPDs involve an assessment of the situation, recognition of events as typical, and a resultant course of action based on previous experience. A number of features distinguish the RPDs model from classical decision models [20]. These include preplanning of decisions to a given situation. This is a point were rules of engagement need to be clear and defined to allow RPDs to not be hindered by cognitive distance or confusion.

2.1 Uniform Battlefield Decision Making

The US Army has a formal process for planning military operations called the Military Decision-Making Process (MDMP) [4]. This process is long and guided as shown in the seven steps listed in the following table. While MDMP is good for organizational and course of action planning, it does not allow for quick decision making that is needed for Soldiers on the battlefield in combat.

Table 6-1: Steps of MDMP

1. Receipt of mission
2. Mission analysis
3. Course of action
4. Course of action analysis
5. Course of action comparison
6. Course of action approval
7. Orders production

Decision making while units are in combat is characterized by the requirement to make decisions quickly. Often, commanders are bombarded with large amounts of information in various forms and must attempt to form a mental model of the situation to use as a basis for decisions. Even if information is organized and rationally chunked together, the limits of working memory preclude decision-makers from considering all of the information available [33]. This leads back to the benefits of RPDs and the functionality of the first COA of skilled decision-makers as viable courses of action. Past researchers have lead to the same conclusion, that decision making may benefit from following the Recognition Primed Decision-Making model described by Klein [1, 16].

3.0 EXPERIENCE IN SA

More experienced officers demonstrate superior skills in decision making [15, 29, 31]. Klein [19] stresses the importance of situational assessment and the experience of the decision-maker in evaluating the shortcomings of a course of action. In an experiment of identifying locations of units on a battlefield, experienced officers could identify significantly more locations of their own and enemy troops than less experienced officers. Furthermore, experienced officers identify the strongest enemy locations and areas of highest enemy threat, which the less experienced offices could not do [31]. Research suggests that some of the differences between experts and novices in decision making may be due to a difference in the ability to perceive meaningful patterns [30] and to associate certain actions with those patterns [25]. Experts have been shown to use visually-based schema that are specific to their area of expertise [15]. While situation assessment by a skilled worker appears to take place very quickly, the basis for it is built up by continual appraisal [29]. Therefore, the sooner a Soldier can become aware of the forming of patterns in a given situation, the sooner RPDs can be initiated to correctly deal with the situation.

Researchers have indicated that the similarity of trainees' knowledge structure to an expert structure was correlated with skill acquisition and was predictive of skill retention and skill transfer [2]. Training to increase a novice's ability to quickly and accurately assess battlefield situations comes from experience with a variety of situations. Experience alone is not the best teacher, but rather experience with appropriate feedback from an expert coach or mentor. Experience can be gained through training. Effective training can take place in a number of different ways, reading books, participating in field exercises and through use of virtual and constructive training systems [12]. Virtual simulations have been shown as effective means for training decision making and situational assessment [9, 26, 23] and have the advantages of reduced cost, capability to display multiple physical locations, accurate After Action Review capabilities, and less time spent on logistics over training in the field. Virtual simulation provides an opportunity for Soldiers and leaders to go through more scenarios in a given block of time.

4.0 DIGITAL SYSTEMS TO ENHANCE SA

The US Army has a simple definition for situation awareness. SA is seen as the commander's understanding of the battlefield [4]. Frequently the term is used to describe information available on Tactical Operations Center (TOC) displays or SA displays. The purpose of the displays is to provide decision-makers with enough information about what is occurring and likely to occur to make quality decisions. Digitization programs seek to capitalize on networked computer systems to enhance information flow to produce a better common operational picture (COP). Theoretically, this allows decision-makers to maintain a clear, accurate, and shared vision of the battlefield necessary to support both planning and execution [27].

In an Army unit equipped with digital systems, information is typically stored in common databases and can be accessed through a tactical internet, much like the World Wide Web Internet. Much of the information, such as unit positions, can be displayed spatially as graphics, which is much easier to process cognitively allowing for possibly quicker situation awareness and a course to a quicker COA for decision-makers. Through the application of advanced technology on the battlefield, the U.S. Army is well on its way to establishing full situational awareness [3] for the Soldier and of the battlefield. The use of digital automated systems to increase situation awareness is a promising method to allow decision-makers to develop a more accurate mental model of the situation, and consequently increase the quality of decisions [13].

Digital networks allows commanders to maintain an awareness of their subordinate units, known as friendly SA. In mechanized units, for example, each vehicle tracks its geographical position by means of a Global Positioning System (GPS) receiver. Periodically, its position is transmitted back to the unit

network where it can be displayed on the commander's computer. This ensures the commander knows the location of all the vehicles in the unit, at all times. A study conducted by McGuinness and Foy [24] found commanders rated this factor to be one of the most helpful for maintaining situation awareness.

As well as friendly SA, commanders also require SA concerning the enemy. Military Intelligence specialists filter advanced imagery and reports to locate enemy units and enter information into the database. Once the location of enemy units on the battlefield can be accurately presented, commanders can recognize patterns of activity and estimate the enemy's intent. With this information, the commander's options become clearer.

This timely sharing of information allows better coordination among units and significantly improves the ability of commanders and leaders to make decisions quickly [3].

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