Situational Awareness

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This article presented a conceptual overview of situational awareness and provided a breakdown of its components, as well as examples of situational awareness systems.

Situational Awareness (SA) is the ability to understand the current state of a situation and to predict how it might evolve in the future. It is essential for effective decision-making in a variety of domains.

For instances:

- **Aviation**: Pilots need SA to safely navigate their aircraft and avoid collisions.
- **Military**: SA is critical for making decisions about the deployment and use of forces. For example, a tactical commander must be able to understand the current state of the battlefield, the potential threats to their forces, and the best course of action to achieve their objectives.
- **Emergency response**: First responders need SA to quickly assess a situation and make decisions about how to best help those in need.
- **Business**: Managers need SA to make informed decisions about their businesses, such as where to open new stores or how to allocate resources.
- **Sports**: Athletes need SA to anticipate their opponents' moves and make split-second decisions about how to react.

Having a breakdown of the SA topic is valuable for systems designers who build SE supporting systems. We start with the three main activities involved in SA:

- **Gathering information**: This activity involves collecting data about the environment through your senses, memory, and other sources, such as communication with others.
- **Interpreting the data**: This activity involves making sense of the data by understanding what it means and how it relates to other information.
- **Foreseeing the consequences**: This activity involves predicting what will happen next by understanding the current situation and how it is likely to change.

SA is not a static state, but rather a dynamic process of gathering information, interpreting it, and making decisions. The environment is constantly changing, and so too must SA. In order to maintain SA, individuals must be able to effectively scan their environment, identify threats and opportunities, and make plans to respond. Here is a concept of the environment.

The Environment

The environment is everything that is happening around you. It includes the physical environment, such as the terrain, weather, and other objects; the social environment, such as other people and their actions; and the cognitive environment, such as your own thoughts and feelings.

The environment can be broken down into two main components respecting to the interaction with SA:

Perceptible things: Anything that can be sensed by the five senses: sight, hearing, smell, taste, and touch. In the context of SA, perceptible things include objects, people, events, and changes in the environment.

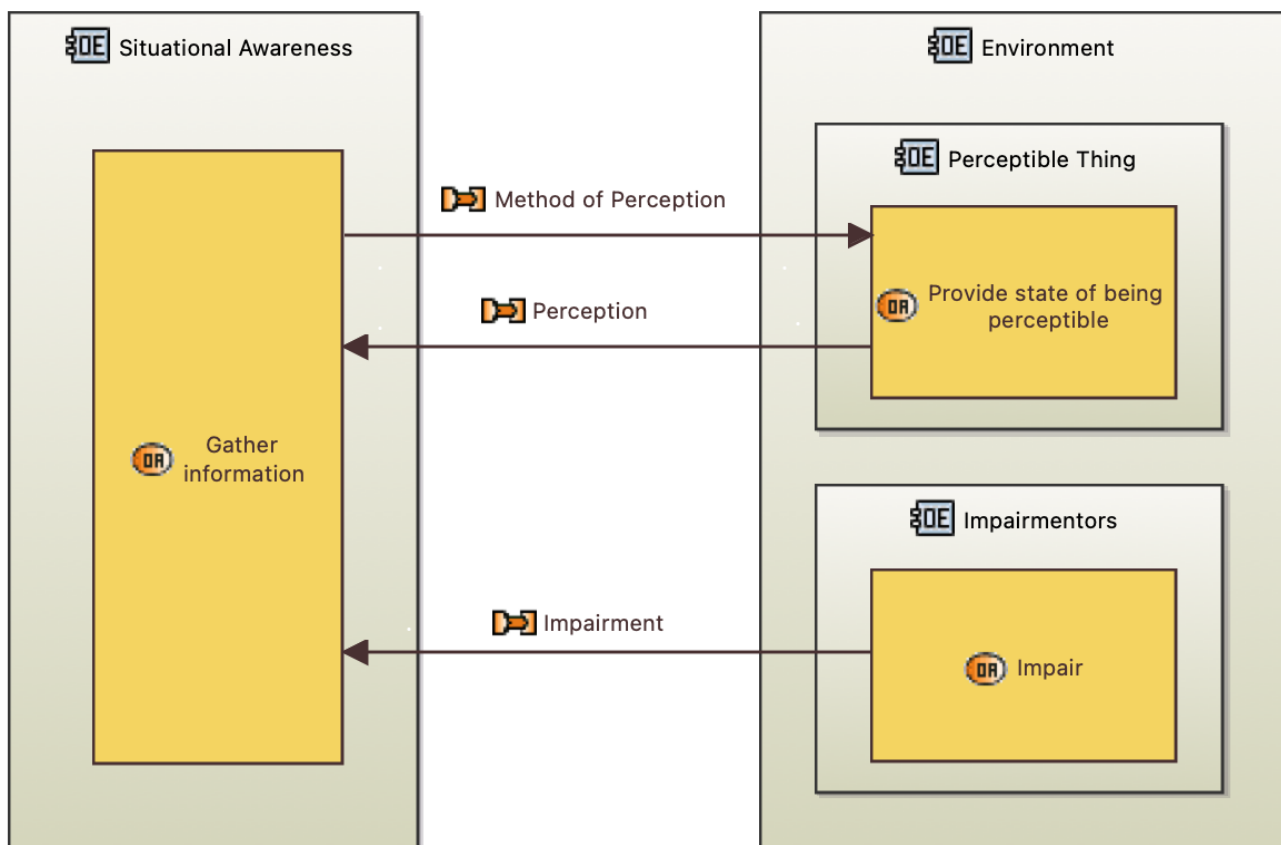The activity that Perceptible Thing allocates:
- Provide state of being perceptible

Impairmentors: Anything that can interfere with your ability to perceive the environment. They can be physical, such as fatigue or poor visibility; cognitive, such as stress or distraction; or social, such as groupthink or peer pressure.

The activity that Impairmentor allocates:
- Impair

Fig1: The architecture of SA & Environment, the key operational entities and activities

Perception & Impairment

Perception is the process of interpreting the information that you gather from your senses. It includes recognizing objects, understanding their meaning, and predicting their behavior. In relation to Method of Perception, different methods can give different results

An **impairment** is a loss or reduction in function. In the context of SA, an impairment is a loss or reduction in the ability to perceive the environment.


Method of Perception

The method of perception is the way that SA gathers information about the environment. It includes your senses, your attention, and your memory.

Comprehension & Projection

Comprehension is the ability to understand the meaning of the information that is perceived. This involves identifying objects, understanding their relationships to each other, and predicting how they might change in the future.

Projection is the ability to anticipate what might happen next. This involves using the information that has been perceived and comprehended to make predictions about the future state of the environment.

Fig2: The three main activities involved in SA.

Command and control (C2) systems: C2 systems are used to collect and distribute information to commanders and soldiers. This information can include the location of friendly and enemy forces, the status of weapons and equipment, and the weather conditions.
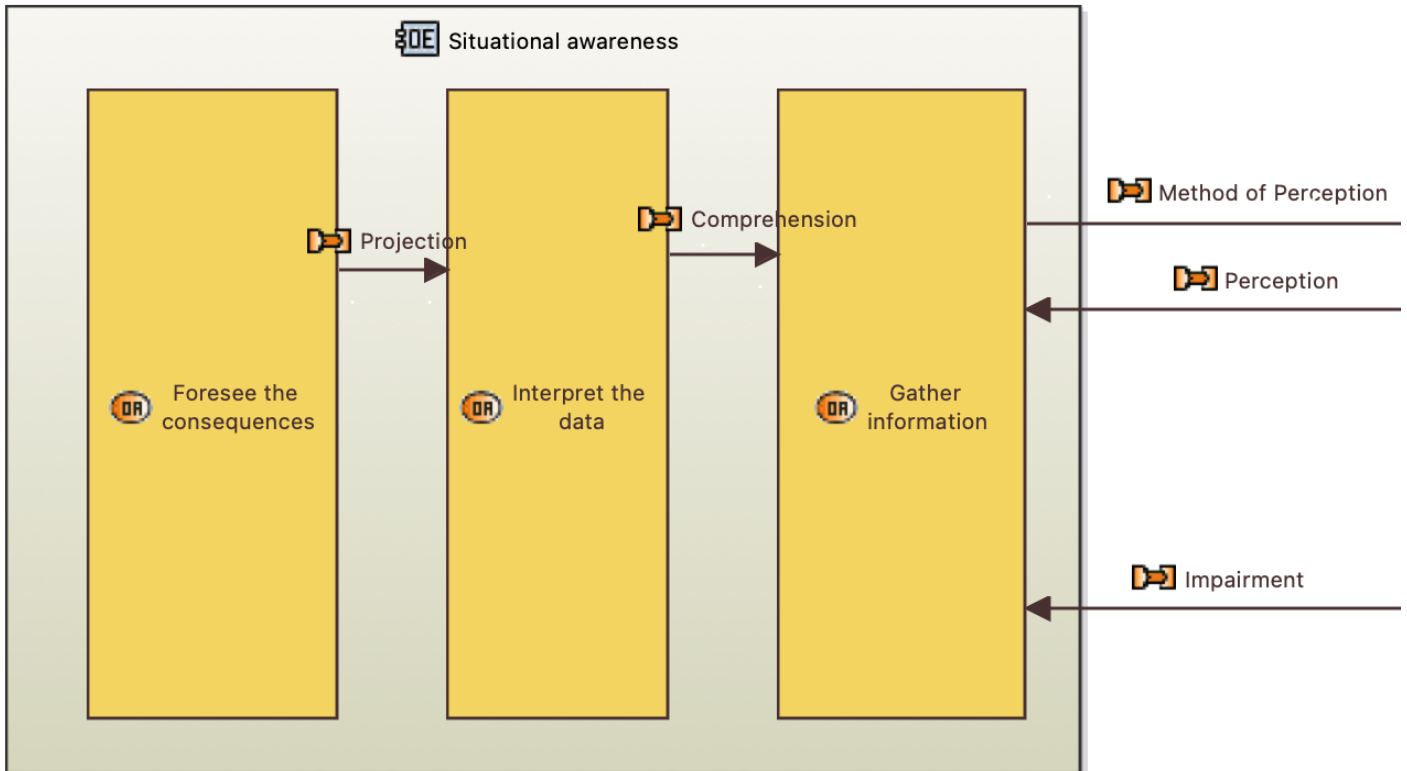
Situational Awareness Systems (SAS)

Situational awareness systems (SAS) are designed to help people improve their situational awareness. They do this by providing information about the environment, such as the location of other people, objects, and threats. SAS can also be used to track the movement of people and objects, and to predict their future behavior.

Here are some examples of situational awareness systems:

Battlefield management systems: Battlefield management systems are used to track the progress of a battle. This information can be used to identify areas of weakness in the enemy's defenses, and to plan and coordinate attacks.

Automatic dependent surveillance–broadcast (ADS-B) is a surveillance technology that allows aircraft to broadcast their position, altitude, and other data to ground stations and other aircraft in real time. ADS-B can be used to improve situational awareness for pilots and air traffic controllers.

Ground-based radar is a system that uses radio waves to detect and track aircraft. Ground-based radar can be used to provide situational

awareness for air traffic controllers, pilots, and other ground personnel.

Surveillance cameras can be used to provide situational awareness in a variety of settings, such as airports, train stations, and public spaces. Surveillance cameras can be used to identify potential threats, track the movement of people and vehicles, and provide evidence in the event of an incident.

Sensor fusion is a technique that combines data from multiple sensors to create a more complete and accurate picture of the environment. Sensor fusion can be used to improve situational awareness in a variety of settings, such as military operations, search and rescue operations, and traffic management.

Decision support systems can be used to help individuals make decisions in complex and dynamic environments. Decision support systems (DSS) can provide information, analysis, and recommendations to help individuals make informed decisions.

There are many different types of SAS, each with its own strengths and weaknesses. Some SAS are designed for use in specific environments, such as the battlefield or the workplace. Others are designed for general use. The effectiveness of SAS depends on a number of factors, including the quality of the information they provide, the user's ability to understand and use the information, and the user's training.

A breakdown of SA can provide a framework for further analysis, such as system analysis, which helps identify the key questions that need to be answered in order to perform system design activities.