Perception: What's your view?

By Peter Dann

In this article I hope to demonstrate, as simply as possible, what perception is, why it causes problems and the implications this can have in affecting not only the Marine Pilot's but also the Bridge Teams situation awareness.

Perceptions Gone Wrong:

A large, high windage vessel is in the midst of being swung in bad weather (strong winds and passing rain showers) and a strong tide. The pilot is mainly basing his perceptions of the developing situation on information from a portable pilotage unit (PPU), radars and other instrumentation and only occasionally glancing outside to use visual cues.

All seems to be going well, the pilot's perceptions based on the equipment being used is that the swing is going according to plan and the vessel should swing well clear of all obstructions. Unfortunately all is not as it seems, the PPU has developed an undiagnosed problem and the radar picture quality has deteriorated with the passing rain showers. The Captain then calls out that the vessel is rapidly approaching the berth.

What has gone wrong (from a perception point of view)?

For starters the pilot has been so intent on swinging the ship by electronic means that his attention has narrowed to using just that medium and has thus missed the vital visual clues that would have altered his perception of the developing situation and allowed him to react accordingly. The pilot has been basing his understanding of the situation "upon a misrepresentation of reality" and his responses had been (to the pilot at least) a "rational consequence of this misrepresentation" (Schager, 2008).

The Captain though, as part of the bridge team has been monitoring the situation for these visual cues and had thus gained a different perception of the developing situation and was thus able to warn the pilot accordingly.

Perception: How it works?

"That which can be known by means of the ears, the eyes, and the sagacity of the mind is very inadequate. The knowledge gained merely through what we see and hear is extremely superficial" (Shen Buhai c. 400 – c. 337 B.C.) (Congjie, 1996)

Whilst Shen Buhai at the time may not have realised it, what he is talking about is one part of the process of perception and he is also warning against the reliance on just this part of the process.

Perception is not only a dynamic process that runs through three often simultaneous and concurrent stages but it is also the end result of the process. The three different stages of the process are:

1. Bottom-up Processing: The knowledge taken in by our senses is affected by the quality of the sensory information that arrives at the brain in order to be perceived. This is known as bottom-up processing and is our representation of the outer world and is based on what is there.

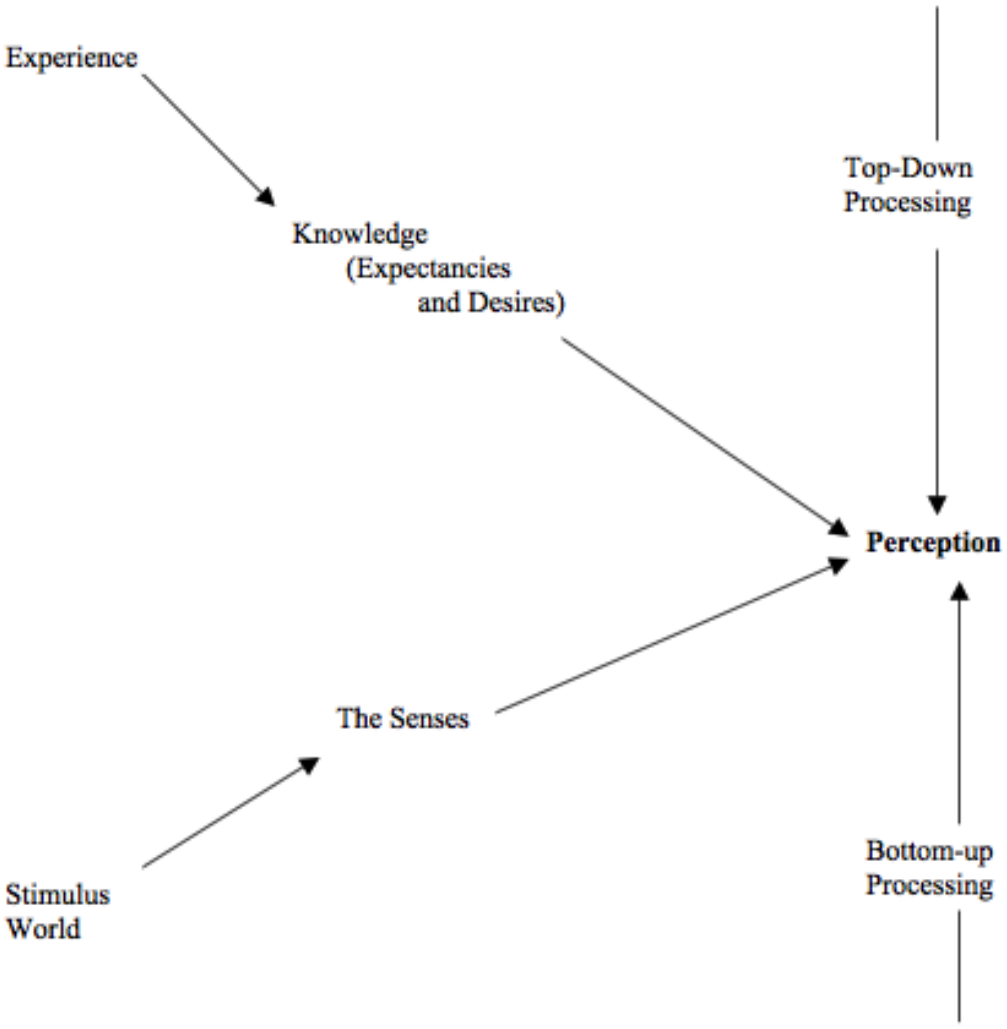
2. Unitisation: This is where past experience has exposed the perceiver to a set of features that have occurred together and have thus become familiar enough to be drawn on in similar situations.

3. Top-down Processing: In this stage we use our memory to understand the meaning of what is there and its stimulus is taken from experience i.e. knowledge. In other words it is based on what should be there.

(Schager, 2008) & (Wickens, Lee, Liu, & Gordon-Becker, 2004)

The relationship between this sensory input (bottom-up processing) and interpretation (top-down processing) is shown in diagram 1.

Diagram 1: The relationship between bottom-up processing and top-down processing sourced from (Wickens et al., 2004)



In the marine pilotage world our perception processes would proceed by analysing events in the pilotage task, such as approaching a harbour entrance. This approach can of course have many combinations but our past experience is brought to bear (via long term memory) and if there are enough similar events unitisation occurs. This unitisation can be helpful as it leads to a more rapid assessment of the situation. If the resources of pre-existing knowledge however, are limited then top-down processing becomes more difficult and the bottom up raw information being provided will then need significant interpretation for us to make sense of the world and what is happening in it.

The interaction between bottom-up and top-down processing is important as there is a reliance on the "interplay between top-down processing, signalling what should be there, and bottom-up processing, signalling what is there" (Wickens et al., 2004).

Experienced marine pilots in familiar waters for example use their top-down processing to make their work easier as they have the requisite body of knowledge to call on, whereas inexperienced pilots in unfamiliar waters will find their pilotage task made more difficult as they need to call on information that to them is still new and thus needs significant interpretation to be useful.

Caution needs to be taken though, as sometimes perceptions are "developed on the basis of inadequate or ambiguous information" and "when the information is inadequate we may unconsciously fill in the missing information ourselves" (Hawkins, 1997). If this allows the situation to become abnormal, the perceptual processes for a variety of reasons will go wrong and our perception will be distorted without us being aware of it. (Schager, 2008).

To summarise

- People act in line with their perception.
- Individuals reaching a perception in line with reality mostly behave rationally.
- Individuals with incorrect perception may behave erroneously, still in line with their understanding.
- Individuals who are uncertain about their perception may be slow to respond, act erroneously, may avoid action or act with hesitation.
- Individuals who are unable to reach a perception will be stuck in the interpretative process, might give up without understanding, be at loss or behave in a purposeless or disorganised manner.

(Schager, 2008)

Several points in this summary could help explain why in the SA Fortius incident both the Pilot and Master when 150 metres from the collision point were aware that something needed to be done, yet they both did nothing. For example, they could have both been stuck in the interpretative process and thus unable to perceive that there was a rapidly deteriorating situation that required decisive action to be taken to avoid the collision.

Perception and the Role it plays in Situation Awareness:

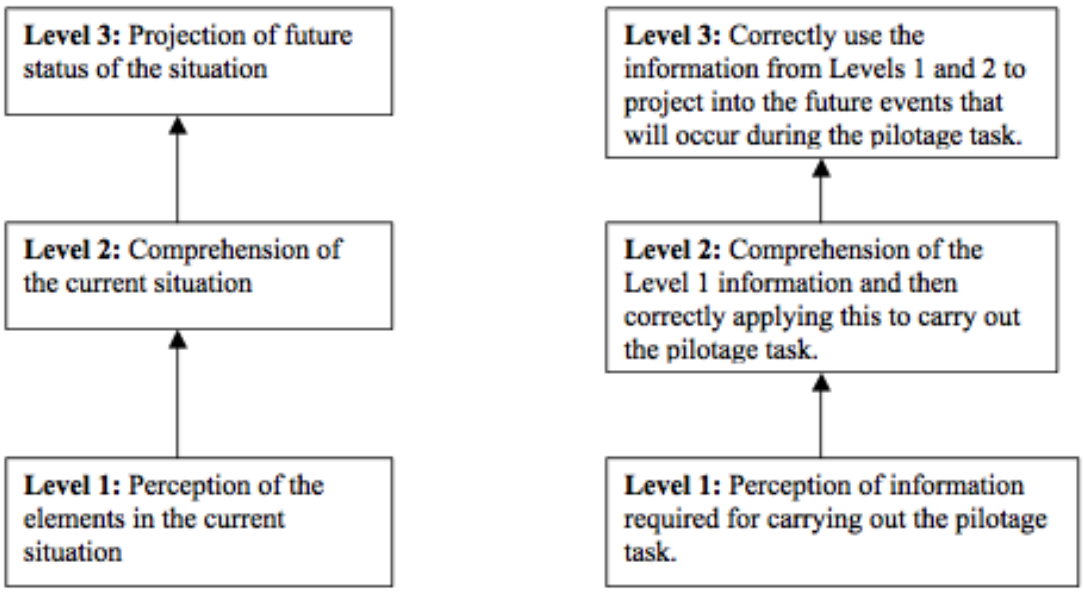
Schager (2008) states that "situation awareness is a concept that is commonly used in the military, in aviation, and in maritime accident reports. The concept seems, however not to be part of most mariners' standard vocabulary". This is strange as studies in many fields including maritime has shown that a large majority of accidents are due to human error caused by insufficient situation awareness.

Situation awareness (SA) meanings, have like many things involved in Human Factors evolved from different views, but the one that has gained most credence is that given by Endsley (1988b) who states SA is "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future"

Endsley (1995b) has used this definition to develop the three level model of SA that is arranged into "three hierarchical levels of situation assessment, each stage being a necessary (but not sufficient) precursor to the next, higher level" (Stanton, Chambers, & Piggott, 2001).

This three level model is shown in Diagram 2 and as can be seen **Level One** involves the perception of the elements of a particular environment, and is associated with in the case of Marine Pilots, perception of information from instrumentation, ship handling characteristics, other bridge team members, other vessels in the vicinity, outside conditions, vessel traffic services, etc. **Level Two** involves understanding what those elements mean (comprehension) and applying them correctly and **Level Three** requires the person to correctly translate the perception and understanding of the environment into a projection of future events likely to occur within that environment. This is the hardest level to achieve. (Matthews, Strater, & Endsley, 2004)

Diagram 2: The three-level model of situational awareness sourced from (Stanton et al., 2001) with an application to the pilotage task.



It should be pointed out that in regards to the Marine Pilot's interaction with the other Bridge Team members "no one is able to share another person's perception. The only thing we can do is to perceive others behaviour and draw conclusions from that" (Schager, 2008). This is a pointer towards the value of having shared mental models that enhance team situation awareness.

Failures in Correctly Perceiving the Situation:

These can be caused by

- At the most basic level, important information may not be correctly perceived.
- Failures in system design to present the required information or there is a failure in the communication process, such as no closed loop communication.
- Difficulty in detecting or perceiving the data. This can be from similar instrument readouts that are the same type but give different information such as speed and water depth readouts that are located beside each other.
- High task loads can prevent important information being attended to.
- Attentional narrowing, external distractions and even omitting to look at the information can lead to failures.
- Prior expectations (hearing or seeing what was expected, not what was there) and task distraction can lead to misperceptions.
- Forgetfulness of initially perceived information can negatively affect SA as it relies on keeping information about a large number of factors in memory.

(Endsley, 1999)

Conclusion:

In conclusion, perception can be thought of as looking into a multi-dimensional mirror, what goes into the mirror is not necessarily what comes out, it is deflected by many things whilst inside. Everyone will see a different view when they look into the mirror. What's yours?

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